Compressed Air Magazine

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As It Seems To Us

VICTIMS OF HABIT

THE destiny of the salmon is the tin can. To the angler with rod and line this game fish means sport. To commercial fishermen with nets and boats it is a crop to be taken and converted into money. To the general public everywhere it is a palatable food, procurable at small cost. An innate urge impels the salmon to seek spawning grounds in the headwaters of streams far from their feeding grounds. Man, observant of this undeviating course, profits thereby. Nets are spread in bays and estuaries, and many a silver-spangled leaper that sets forth on this annual hegira from the sea comes to an inglorious end on a grocer's shelf, severed, and encased in tin. Some of the intermediate steps are recounted in an article in this issue.

Much salmon-canning is done in British Columbia, where the industry dates from 1876. Last year the province's pack of this fish aggregated 1,081,000 cases. This was about normal, being 395,000 cases greater than in 1931, but only about half the record catch of 1930. The salmon pack is subject to the fluctuations of the world's buying power, but it is also governed by the scarcity or abundance of the "runs." The sockeye salmon, marked by the deep-red color of its flesh, is the most sought after, as it is in demand in the British market. Late July and early August see the sockeye runs at their height. The spring or quinnat, a larger fish than the sockeye, was first canned in the United States. It runs in the spring and early summer. Cohoes make their journey landward during late summer and early autumn. Other important species in British Columbia are chums, pinks, and bluebacks. The steelhead, prized by sportsmen, is never abundant, and the pack seldom exceeds 1,000 cases.

The construction of power dams in rivers in the salmon country brought complications to the salmon-fishing industry. These barriers threatened to interfere seriously with the perpetuation of the finny tribe. Because of this, every hydro-electric plant now built there includes an artificial waterway by which the salmon can surmount this obstacle in their course. So-called ladders, which resemble stairways and have pools on top of each lift where the fish may rest before attempting the next leap, are standard equipment. Curved bars prevent the salmon from being washed back down but do not impede their ascent, as they leap over them.

In the case of high dams, ladders are augmented by elevators. The final step in the ladder leads to a steel box on wheels that is pulled up an inclined railway as often as it becomes loaded with fish. For a long time it was considered that 50 feet was the greatest vertical distance the fish would climb by ladder, but it is now established that they can negotiate greater heights. The Baker River Dam in Washington, Oreg., is 253 feet high, but means have been provided by which the salmon are successfully attaining its crest. A ladder suffices for the first 100 feet. Then comes a 700-foot sluice which empties into the steel car of an elevator.

SAFETY IN MINING

GREAT progress has been made in making metal mines safe for workers. Large-scale disasters are now virtually unknown; and it probably could be proved by statistics that a person subjects himself to greater chances of injury in crossing a busy city street than in entering a well-run mine. Safety is a paramount consideration of mine managements for both humanitarian and economic reasons. It not only is a fine thing to be safe but it also pays. But even where it costs money to safeguard workmen it is being done. In support of this statement we have the report of the Phelps Dodge Corporation, whose Morenci Mine in Arizona is one of the outstanding properties in the country from a safety standpoint. Satisfactory results were achieved, the statement says, because the corporation was absolutely sincere in its desire to conduct every one of its operations without accidents, and "challenged any person to prove a single instance in which cost or production was placed ahead of safety."

A full account of the safety methods practiced in the Morenci Mine would be a long one. Reduced to skeleton form, it embodies the following measures: Physical examination of new men; safety school for all new men and bosses before starting work; annual reëxamination of all men and bosses under the safety rules; standardization of operations; 100 per cent first-aid training; workmen's safety meetings; workmen's inspection committees; safety awards to workmen and their families; safety bonuses for bosses and foremen; moving pictures; publication of a safety bulletin in newspaper form; thorough investigation of all accidents by committees; classification of 90 per cent of all accidents as the fault of supervision or of the company; 100 per cent electric blasting; use of safety primers in blasting; competition for a safety trophy between branches and departments; use of safety equipment and clothing such as protective hats, goggles, safety shoes, safety belts, knee pads, leggings, etc.; use of red tags in making inspections; bulletin boards; and a safety exhibit showing standard tools, equipment, safeguards, and special markings and models to teach standard practices such as electric blasting.

EGYPTIANS USED CAISSONS

EGYPTOLOGISTS working under the auspices of the Metropolitan Museum of Art of New York City have found evidence that the principle of the caisson was known and used by the people that inhabited Egypt 4,000 years ago. At Lisht, 40 miles from Cairo, excavations in a court adjoining a pyramid of King Se'n-Wosret I revealed a shaft which had been carried through unstable ground by a method similar to that practiced by modern engineers.

This shaft provided access to underground burial chambers which had been cut out of soft limestone. To reach the limestone stratum from the surface it was necessary to penetrate a top layer of red sandstone, a conglomerate, and finally a varying thickness of loosely consolidated white sand. This last-named material ran in from all sides of any excavation made in it, thereby undermining the harder overlying strata and allowing them to give way.

Upon observing these conditions, the archaeologists were at a loss to understand how the Egyptians had sunk their shafts to the stable limestone, and began an investigation of the subject. This disclosed that caissons had been used. The shafts were rectangular in cross section and lined with brick. Study of one of the linings established the fact that it had been built from the top downward and sunk progressively deeper as the excavation was carried downward.

The indications were that the work was conducted in somewhat the following manner: A rectangular trench was cut in the hard surface rock outside the line of the finished shaft section. This trench was carried down to the soft sand layer. At the same time the center of the block of rock thus outlined was hollowed out, leaving walls slightly thicker than the brick lining that was to be built. When these operations were completed, the result was a stone caisson all ready in exact position for sinking. Working inside this protection, laborers removed the sand from beneath the lower edges of the caisson, which thereupon sank of its own weight. Care had to be exercised to remove material from under all four edges equally. Meanwhile, courses of brick were being laid on the upper rim of the caisson. As the open-ended stone box penetrated farther into the ground, more brickwork was added at the top. In effect, a shaft was built on the surface and sunk into position. To aid the caisson in penetrating the sand its lower edges had been beveled to give them cutting action.

AMBROSE LANSING, director of the expedition that made this study, states that this find represents the earliest known application of the caisson to construction work.

WACKER DRIVE BUILDING, AGLEAM WITH ELECTRICITY.

Chicago at Night

WRIGLEY BUILDING AND WABASH AVENUE BRIDGE.

Ewing Galloway

THE TRIBUNE TOWER FROM ATOP THE HOTEL SHERMAN.

In little more than 100 years Shekagong, the "wild onion place" of the Ojibwa Indians, has become the second city of the nation. This summer Chicago will be host at an International Exposition to celebrate a Century of Progress since the town was organized. Thousands of visitors will gain views of the city such as are here presented.

Photos by F. Chadde and R. T. Jackson

MERCHANDISE MART, WORLD'S LARGEST BUSINESS STRUCTURE.

HOLSTEIN HEIFERS

on a dairy farm in Wisconsin. A Holstein cow gives more milk than a Jersey or a Guernsey, but the milk is not so rich in butterfat.

The Milk We Drink

C. H. VIVIAN

SOME day, perhaps, some nation will erect a statue of a cow to commemorate that gentle animal's many benevolences to the human race. Certainly there is no other dumb creature to which man owes so much or upon which he depends so greatly. More than a half-century ago, HOUSEHOLD WORDS, a British publication, acknowledged this debt in a tribute from which the following is a quotation:

"If civilized people were ever to lapse into the worship of animals, the cow would certainly be their chief goddess. What a fountain of blessings is the cow! She is the mother of beef, the source of butter, the original cause of cheese, to say nothing of shoehorns, hair-combs, and upper leather. A gentle, amiable, ever-yielding creature who has no joy in her family affairs which she does not share with man. We rob her of her children that we may rob her of her milk, and we only care for her when the robbing may be perpetrated."

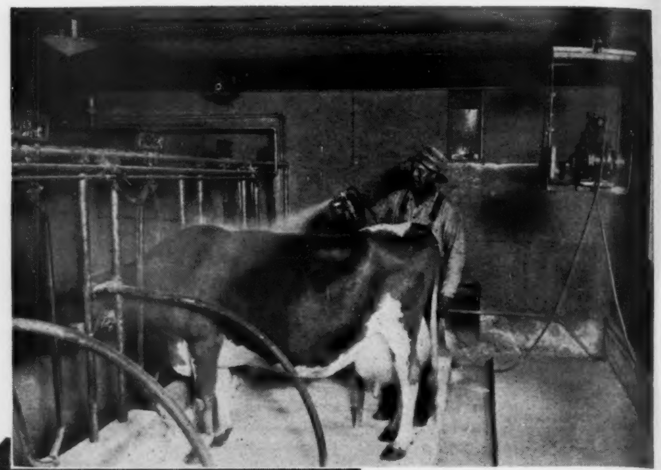
From time immemorial, cow's milk has been a leading food, and in the care and upbringing of children it has become indispensable. Other animals are important sources of milk in some places—reindeer in the north lands, camels in the desert, sheep and goats elsewhere; but, even so, the term milk commonly denotes the product of the docile cow.

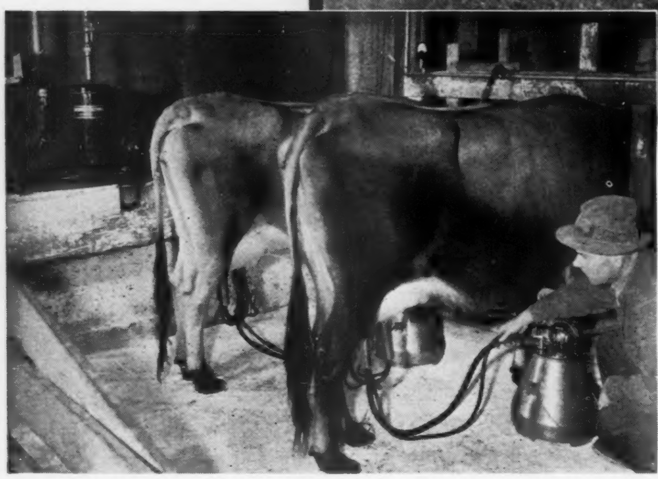
Milk and its products have been articles of commerce down through the ages; but only recently has the business attained the status of what we now call the dairying industry. The cow, the very embodiment of peace and tranquillity, has been drawn nearer and nearer the vortex of that great swirl in modern civilization termed merchandising. At one time virtually every family kept a cow: today there are vast cities where children grow up without ever seeing one. New York City obtains some of its milk supply from as far as 400 miles away. In and about all large communities have been set up great enterprises to provide the essential links in treatment and transportation between the cow and the household.

Milk is a very complex compound. It consists essentially of an emulsion of fatty globules—the cream—in a watery, alkaline solution of casein and of a variety of sugar called lactose. The fat and the lactose are carbonaceous in character. The casein, which is the principal ingredient in cheese, and some of the albumin, are nitrogenous. Milk also contains phosphoric acid, chlorine, lime, soda, potash, magnesia, and iron oxide. When fresh, it has some hydrogen-sulphide gas dissolved in it, but this escapes after short exposure. Milk does not have a fixed composition. Its makeup varies rather widely with the race and breed of the cow which gives it, and even the product of the same cow fluctuates from time to time.

Not so long ago milk was called the perfect food, but since the discovery of vitamins this estimate has had to be revised. Vitamins A and G are abundant in milk and withstand ordinary pre-marketing treatment. Vitamins B and C are present in small amounts in raw milk, and some of those are destroyed by pasteurization. Vitamins D and E are found in milk, but in negligible quantities as compared with some other foods. The discovery of these deficiencies has led some dietitians to advocate raw milk as a child food and has brought agreement among all authorities that milk, whether raw or pasteurized, must be supplemented by certain desirable foods which contain the lacking vitamins. The shortage of Vitamin D, the antirachitic vitamin, is of chief concern, and it is to offset this that cod-liver oil or some other substance rich in Vitamin D is recommended for child-feeding. As a protection against scurvy, the milk diet is augmented by orange juice, tomato juice, potato water, or some other food of high Vitamin C content. It has also been established that it is possible, by controlling the fodder of cows, to introduce certain vitamins into natural milk. A specific instance of how this is done will be mentioned later.

Notwithstanding the recent revelation of its shortcomings, milk is still easily the most





COWS AT PLAY AND AT WORK

The central picture shows heifers on the Walker-Gordon farm, where your milk stock is watched over with great care. Cows added to herds are secured in sections free from bovine infections, and are held under strict observation 60 to 120 days before being placed in the milking line. Each milker is in production the ten months of the year she is fresh. During her two months of vacation she has a calf. At an early age her offspring joins other calves in a separate field, where they grow up protected from disease. Many milk cows are profitably productive up to ten or twelve years of age, and one animal continued to return more than her keep until she was nineteen years old. Holsteins, Jerseys, Guernseys, and Brown Swiss are represented in the herds.

At the top a Guernsey cow on an Indiana farm is receiving a spray of insecticide from an air gun.

Mechanical milking is quick and sanitary. At the left is a close view of the suction-operated apparatus that is now much used.

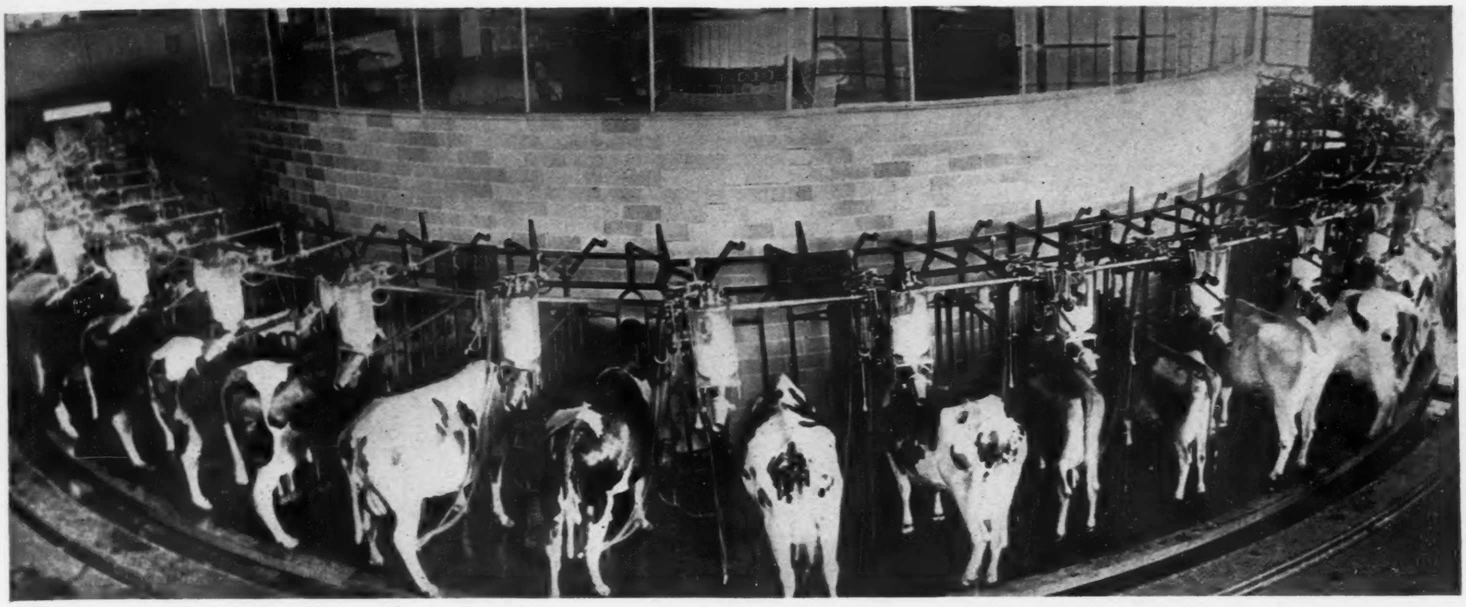
important single food we have, and it is only natural that great care should be taken to safeguard its purity. The production and marketing of milk are supervised by federal, state, county, and municipal agencies. The closeness of the supervision increases with the denseness of the population, and reaches its height in the larger cities.

Despite its many virtues, milk was formerly at times a great enemy to public health. It carried disease germs broadcast, and epidemics ensued. Some milk-borne epidemics still occur, but with less frequency year by year. The U. S. Public Health Service is authority for the statement that in the 7-year period of 1924-1930, as many as 327 outbreaks of contagious diseases in this country were traceable to milk—an average of 47 a year. Most prevalent among them were: typhoid fever, 217; scarlet fever, 40; septic sore throat, 33; diphtheria, 8. These, and tuberculosis, have long been known as the most dangerous diseases which might be spread by milk. Virtual eradication of the tuberculosis hazard has been effected by instituting a regular examination of milk cows and by eliminating those animals that fail to show a negative test. Control of the others is exercised by treating the milk before selling it. Most important in this treatment is the process of pasteurization.

Strangely enough, pasteurization was first applied to wine. Experiments by the eminent French scientist, Louis Pasteur, showed that heating wine to from 120° to 140° F. would prevent abnormal fermentation and souring. He later found that a similar treatment kept beer from souring. Pasteur made his discoveries prior to 1865; but not until many years later was it generally recognized that the heating of milk protected the public health. Dealers, however, early learned that application of heat improved the keeping qualities of milk, and they surreptitiously practiced a crude form of pasteurization. Heating for health promotion was first recommended in 1889; but the public refused to accept the theory and consistently opposed pasteurization. Cincinnati was the first large city to adopt it, in 1897. New York instituted it in 1898, Philadelphia in 1899, St. Louis in 1900, Boston and Chicago in 1908. Consumers still were not convinced of its benefits, however, and many dealers that pasteurized dared not admit it to their patrons. New York City in 1906 prohibited clandestine pasteurization, and in 1910 began to regulate the time and temperature of the process. Eventually, after repeated scientific studies had proved that the heating of milk under definite conditions killed pathogenic or disease-forming organisms and detracted little, if at all, from its nutritive value, pasteurization received public approval.

The growth of pasteurization has been very rapid during the past twenty years; and, according to the latest figures, about 87.5 per cent of the milk delivered in cities of the United States of 10,000 population or greater is so treated. Only 3 per cent of the milk supply of cities having more than 500,000 inhabitants is now unpasteurized. There is a notable decrease in pasteurization as we go down the municipal population scale, and the percentage of milk thus processed falls to 52 per cent for cities in the 10,000 class. Below that figure, it drops abruptly, the average being only 27 per cent.

Although it is agreed that pasteurization makes milk a safer food, health experts have long been in controversy over the relative



TAKING BOSSY FOR A RIDE

Walker-Gordon cows are mechanically milked three times daily, 50 at a time, on this rotating platform which is termed the Rotolactor. Each animal is washed with a water spray, dried by warm air, and has her milk taken from her during the 12½ minutes she spends in making a complete revolution. A vacuum of 15 inches of water pressure is alternately applied and discontinued 43 times a minute by electrical control, thus simulating the action of human hands. The milk is delivered into a glass receptacle above each cow; is automatically weighed; and a card-index is kept of production. The animals are retained only so long as they continue to pay their way. The cows enter and leave the milking room via tunnels from the barns, and step aboard the turntable at the rate of four a minute. They arrive in the same order each time, and the last cow from each barn wears a bell. This arrangement enables the checker at the weighing station to keep his records straight.

When this model farm was started, those directing it asked Cornell University for an able young man from its agricultural college to assist in the work. The "high" man in the graduating class was offered the job; but he declined it because he wanted to be nearer a large city. Second in line was Henry W. Jeffers. He accepted, took avidly to the work, invented the rotolactor, and is today president of the company.

At the right is a typical, modern city milk plant. It is the new station of Weisglass Dairies, Inc., at Mariner's Harbor, Staten Island, where milk for New York City consumption is pasteurized and bottled.

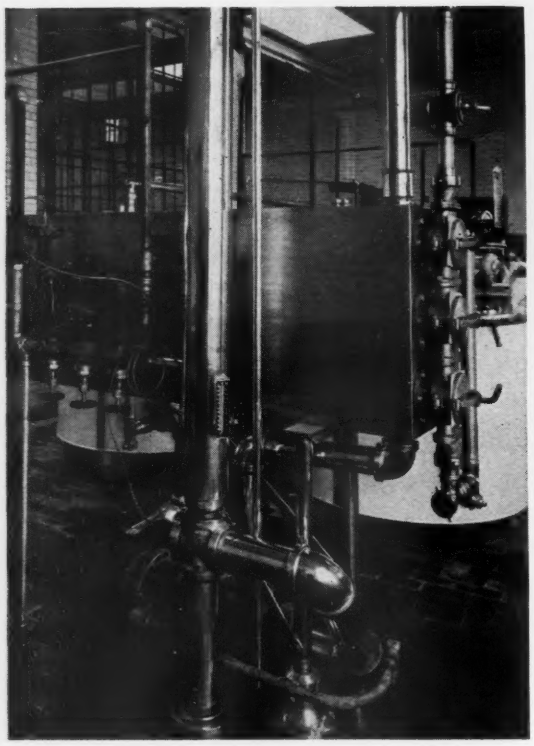
growth-producing properties of raw and pasteurized milk. Much data have been compiled on the subject. Statistics gathered by the U. S. Public Health Service, and involving 3,700 children between the ages of two and six, tend to show that there is no significant difference in the rate of weight increase resulting from feeding either raw or pasteurized milk predominantly, but that there is considerably more diphtheria, scarlet fever, intestinal disturbance, and rickets among children who receive mostly raw milk.

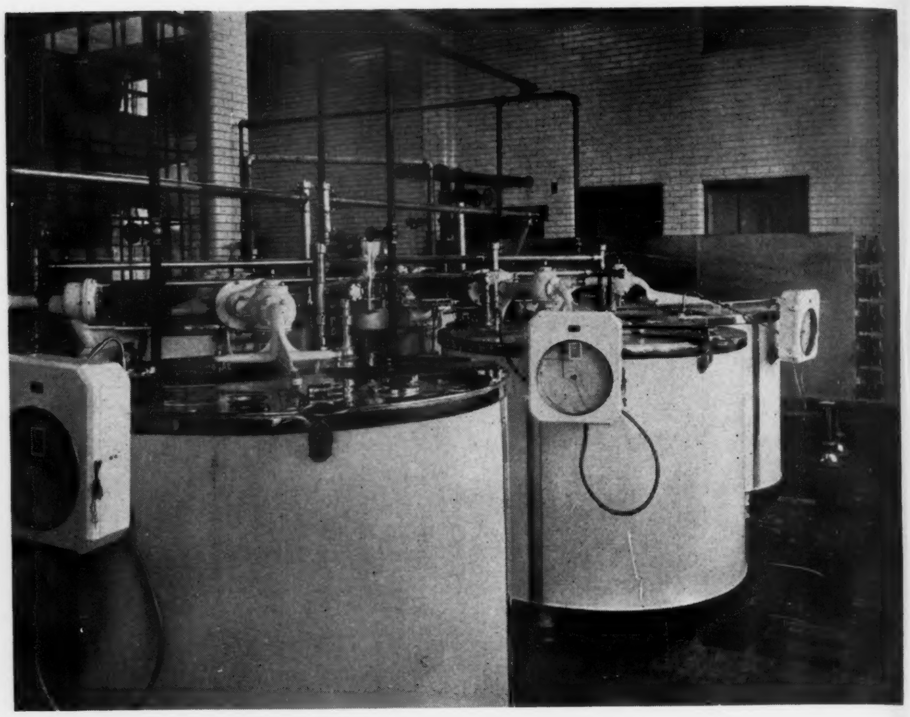
The proponents of raw milk contend that it is possible to safeguard such milk against carrying disease, and that as a nutriment it is preferable to pasteurized milk. Considerable raw milk, produced under rigid control and certified as to purity, is marketed in some of the larger cities and commands a price premium. Such is the product of the Walker-Gordon Laboratory Company, Inc., whose model farm and plant at Plainsboro, N. J., have some unique and interesting features.

This enterprise was started by a group of Boston physicians who believed that properly protected raw milk could be delivered to large cities and that there would be a demand for it for baby-feeding. With a view to serving two large cities from one location, they established their farm at a point midway between New York and Philadelphia. They started with 40 acres and nineteen cows. There are now 3,500 acres and 2,500 cows. Of these animals the company owns only 200. The others belong to farmers, but they live on the farm and are under company control. Owners are paid an agreed price for the milk their stock produces. Incidentally, Walker-Gordon officials are of the opinion that most feeding and milking in the future will be centralized in this manner—the cows remaining the property of many persons, but their care being under one supervision. Advantages include closer control of disease, greater production per cow, and lower costs.

On this farm, 200 cows are on a special diet which is designed to produce milk of high vitamin D content. As it had been discovered that foodstuffs rich in the source of vitamin D obtain antirachitic properties when irradiated with ultra-violet rays, it seemed logical that cows fed on such materials should give milk possessing those qualities. Experiments proved the theory correct. Any one of several foods can be used, but irradiated yeast seems to be the most successful. Milk thus produced contains 20 to 30 times the usual winter content of vitamin D, and is also higher in some other desirable vitamins than is the average milk. No case of rickets developed among 100 babies fed exclusively on this milk. In other tests it effected cures of rickets. Fifteen thousand babies in New York City are now being fed this milk. The success of these experiments indicates that the cow may be likened to a machine, and that by controlling the raw material—her food—it may eventually be possible to correct all the vitamin deficiencies now in her milk. Thus milk may yet attain the status of a perfect food that was for a long time erroneously ascribed to it.

In contrast with past practices, pasteurization is nowadays fairly well standardized, thanks to municipal regulations. It comprises heating every particle of milk to a certain minimum temperature (generally 142° F., but varying from 140° to 145°), holding it at that point for a prescribed time (with few exceptions, 30 minutes), and cooling it rapidly. The U. S. Department of Agricul-





MODERN PASTEURIZING EQUIPMENT

Views in the Staten Island plant of Weisglass Dairies, Inc. The milk is moved by air pressure from storage tanks to and through a Wisner-Peerless "precision" pasteurizer (left) which consists of a nest of tubes surrounded by waterways. The milk enters at 38° and leaves at 144° F. Heating is accomplished by pumping water at 145° in counter direction to the milk flow. The pump, an Ingersoll-Rand Motorpump, is shown at the bottom of the picture. The water circulates at fifteen times the rate of the milk flow.

The heated milk from the pasteurizer passes through a double filter and into one of six Pfaudler holders (above) where it is held at 144° for 30 minutes. Through automatic control the milk flow is directed to each holder in rotation. It requires 7½ minutes to fill or empty each one. At any time, four of the holders are full, one is being filled, and one is being emptied. Recording thermometers on the side of each show the milk temperature.

From the holders the milk passes to the Wisner-Peerless tubular cooler (right) where it is cooled in two stages to 38°. Note the clean, shiny surfaces of the equipment, the tiled and glazed walls, and the general sanitary aspect that prevails.

ture recommends a temperature of not less than 142°. This kills 99 per cent of the contained bacteria, including disease-forming growths, and leaves the greater portion of the desirable lactic-acid bacteria which cause milk to sour and only a small portion of the peptonizing bacteria which cause it to decompose. The nutritive value and digestibility of the milk are not significantly changed. Higher heating, particularly above 145°, has some undesirable effects, chiefly the changing of some soluble elements to insoluble ones.

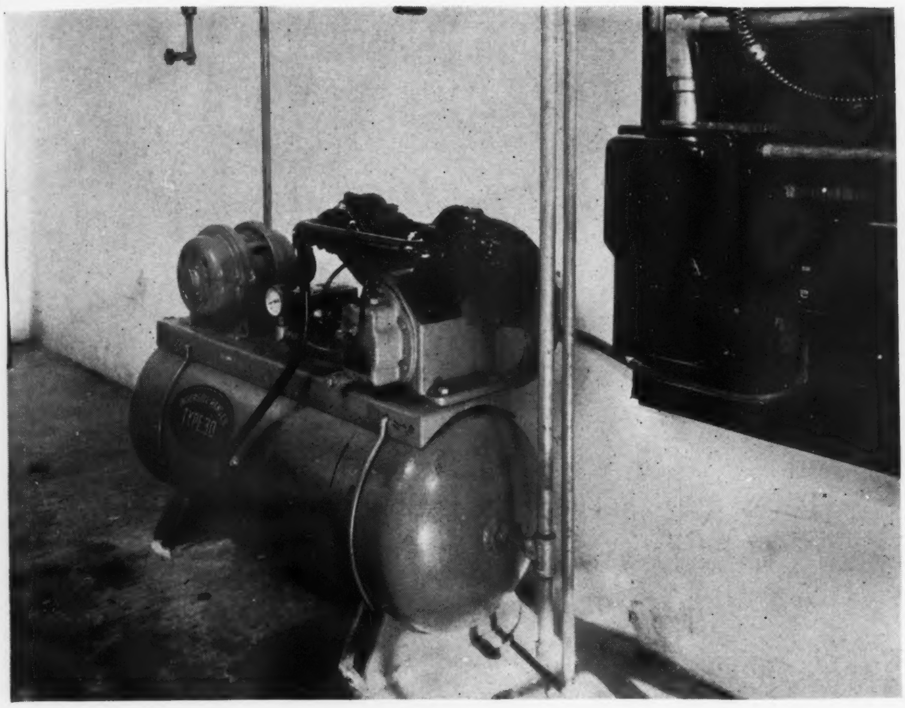
From a commercial standpoint there are two reasons for heating to only the minimum requirement. It takes less heat, and is therefore less costly. It leaves virtually all the cream-forming fat globules in their natural state and, accordingly, does not lower the "cream line" when the milk is bottled. Consumer purchases are dictated by the eye. The fact that the cream is there, but not in a form that reveals it, is a poor sales argument. All dealers, therefore, strive to attain a deep cream line. Pasteurizing at 145° or 146° reduces the cream line about 8 per cent, and at 148° by as much as 31 per cent.

Milk is still a perishable product after pasteurization, and for this reason it must be cooled immediately. The cooling point ranges from 40° down to 33°; and it is desirable to hold it until marketed at not more than 40°. If this is done, there will be only a slight increase in bacteria in 24 hours.

"Flash" pasteurization—heating the milk to a temperature of 160° or more for about one minute and cooling it rapidly—is practiced to some extent, but does not meet the accepted definition of the process. It also requires about 17 per cent more heat than does the longer but lower-temperature process. Substantially all commercial practice conforms to that previously outlined, and the general procedure is to pasteurize the milk in bulk and bottle it afterwards. Pasteurization after bottling is practicable, but relatively more costly.

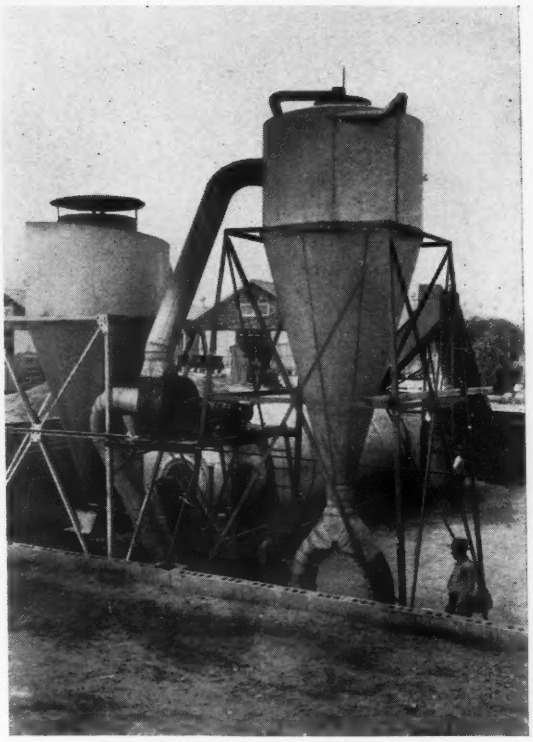
The details and equipment of pasteurization vary with the size of the plant. If the quantity of milk handled is small, it can be heated in the same vessels in which it is afterwards held for 30 minutes. Equipment that permits continuous processing is used in larger stations. The heating and cooling are effected in tubular apparatus, consisting of many lengths of pipe arranged in a horizontal bank and having removable connections at their ends so as to make them continuous. These are really pipes within pipes. The milk flows through the central channel, and the heating or cooling medium flows through the outer one and in the opposite direction. Thus the milk is completely surrounded, and absorbs or gives up heat. In multiple-type units, a number of these smaller tube sections are encased in one large one. Tubular pasteurizers are now so precise in their action that milk can be heated to exactly 142° by using water of just one degree higher temperature. Heating is easier to accomplish than cooling, and there are twice as many cooling tubes as heating tubes.

Pasteurizing and bottling plants are today largely mechanized. This is not only the economical way of handling milk but also the sanitary way. Cleanliness is the cardinal requirement in such establishments, and everything must pass the careful scrutiny of health-department officials. Corrosion-resisting and easily cleaned materials such as glass, stainless steel, and nickel are used in modern equipment. Interior corners and edges are rounded to prevent accumulations of dirt and bacteria. Piping is made in sections for easy dismantling. Following the day's run, everything through which milk has passed, including even pumps, is opened up, thoroughly washed, and then sterilized with live steam. Floors and walls are of tile or of concrete. In either case, they are built for ready cleansing, and the hose is brought into play



MILK-PLANT COMPRESSOR

This motor-driven, air-cooled machine, mounted on its receiver, supplies air for pumping milk in the plant of Weisglass Dairies, Inc. The use of air eliminates the churning action of mechanical pumps that breaks up some of the cream globules. The air is compressed to 40 pounds pressure for storage, then reduced to 9 pounds for use.



THE DEHYDRATOR

Another Walker-Gordon innovation is shown at the right. Alfalfa is artificially dried in this apparatus and then placed in bags for feeding to the cows. The hay is cut whenever its food value reaches the highest point, regardless of weather conditions. The farm experts assert that by this method of dehydration in lieu of drying by sun they are able to seal in food values and to give the cows the equivalent of fresh alfalfa the year round. In addition, the product is claimed to have seven times the vitamin A content of the field-cured alfalfa. The process also yields all the plant, eliminating the loss of leaves which break off when the stalks are handled in the dry state.

after every run. Dividing walls between rooms and large sections of exterior walls are often of glass. The modern milk plant is literally bathed in daylight and sunshine, and proprietors know that it is good business to invite people to look inside and see just how spotless things are.

Hands do not touch the milk while it is being treated and they touch containers very little. If the milk arrives in cans, those cans are scoured by machine before being returned to the owner. Bottles are washed mechanically and the process is so thorough as to leave no doubt of their sterility. They pass directly from the washer to the bottling machine to minimize the possibility of contamination after they are cleansed. The milk also passes immediately to the bottler after it is cooled. The bottling mechanism is an ingeniously contrived rotary table which fills and caps from 25 to 50 bottles a minute. Late-type machines fill bottles to the absolute limit of their capacity and put each cap in place without leaving a single drop on the lip. They reject chipped or cracked bottles automatically. Air under pressure and vacuum are utilized in the working of some of these fillers. As soon as it is bottled, the milk is passed into a room which is maintained at 40° F. or colder, where it remains until loaded out for delivery.

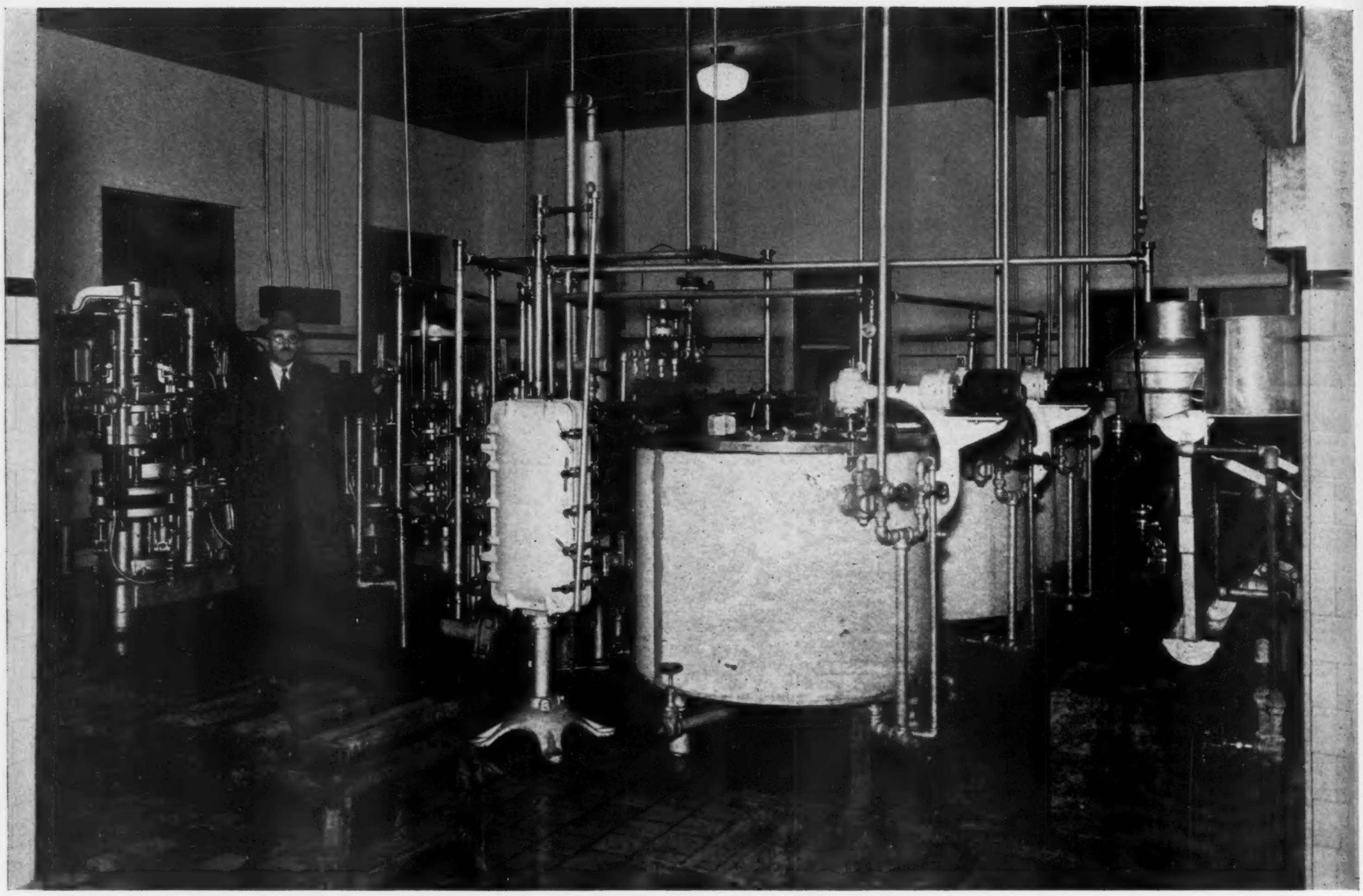
As was mentioned previously, milk dealers always strive to show a deep cream line on their bottled milk. We have noted the fact that heating above certain limits breaks up the fat globules. Another means that has the same effect is agitation. The U. S. Department of Agriculture determined during a study of the subject a few years ago that agitation of milk while it was between the temperatures of 60° and 120° F. was particularly detrimental to the cream line. Since this fact became known, equipment makers have striven to produce apparatus to handle milk with a minimum of disturbance. The multiple-tube pasteurizer is a step in that direction.

It being apparent that the conventional method of moving milk through the pasteurizing process with mechanical pumps caused some agitation, milk-plant technologists gave pumping their attention. Mr. Fred Goldsmith, chief engineer for the Borden Farm Products Company, experimented with compressed-air pumping, and discovered that it perceptibly increased the cream line.

One of the first plants, if not actually the first, to adopt compressed-air pumping on a production basis is the new station of Weisglass Dairies, Inc., on Staten Island, New York City. As the general procedure there exemplifies that followed by many modern milk handlers, we will briefly outline the practice followed in this establishment. The firm has been supplying milk and milk products to portions of New York for many years. Its new plant was established the fore part of this year in line with the prevailing trend to transport raw milk to the city and pasteurize it close to consumers rather than to continue the former system of pasteurizing near the points of production and then having to ship the finished product a considerable distance to market.

The milk is produced in Orange County, New York, by some 100 dairymen, who deliver it at the company's creamery at Bullville. There it is weighed, tested, and cooled to 35° F. by electric refrigeration. It is then pumped into a truck-mounted insulated tank lined with stainless steel, and in this it is transported the 87 miles to the Staten Island depot.

At the pasteurizing plant, which the truck reaches after about four hours' run, an air line is connected at the top of the tank and a milk line is connected at the bottom. A turn of the air valve serves to move the milk into the plant by displacement and



without the churning effect imparted by mechanical pumping. It is there delivered into two insulated, glass-lined storage tanks which hold 12,000 quarts each. It enters these at the bottom so as to reduce the formation of foam.

From these storage tanks is drawn the supply of milk for the pasteurizers. In plants that serve New York, pasteurizing usually starts at midnight. The milk is moved from the tanks by air pressure, in a manner similar to that described. The air is supplied by an Ingersoll-Rand Type 30 air-cooled compressor having two single-stage cylinders and being driven by a General Electric ¾-hp. motor. It discharges at 40 pounds pressure into a receiver from which the air is drawn as required. The pressure is reduced to 9 pounds for pumping; and when maintained at that point it will move 12,000 pounds of milk per hour through the pasteurizer. Clean air is important to this operation, and proper means have been set up to provide it. The compressor is situated in a room apart from where the processing is done. Intake air passes through three layers of felt which remove dust. A Protectometer filter removes oil and dirt from the discharged air.

MODERN SMALL PLANT

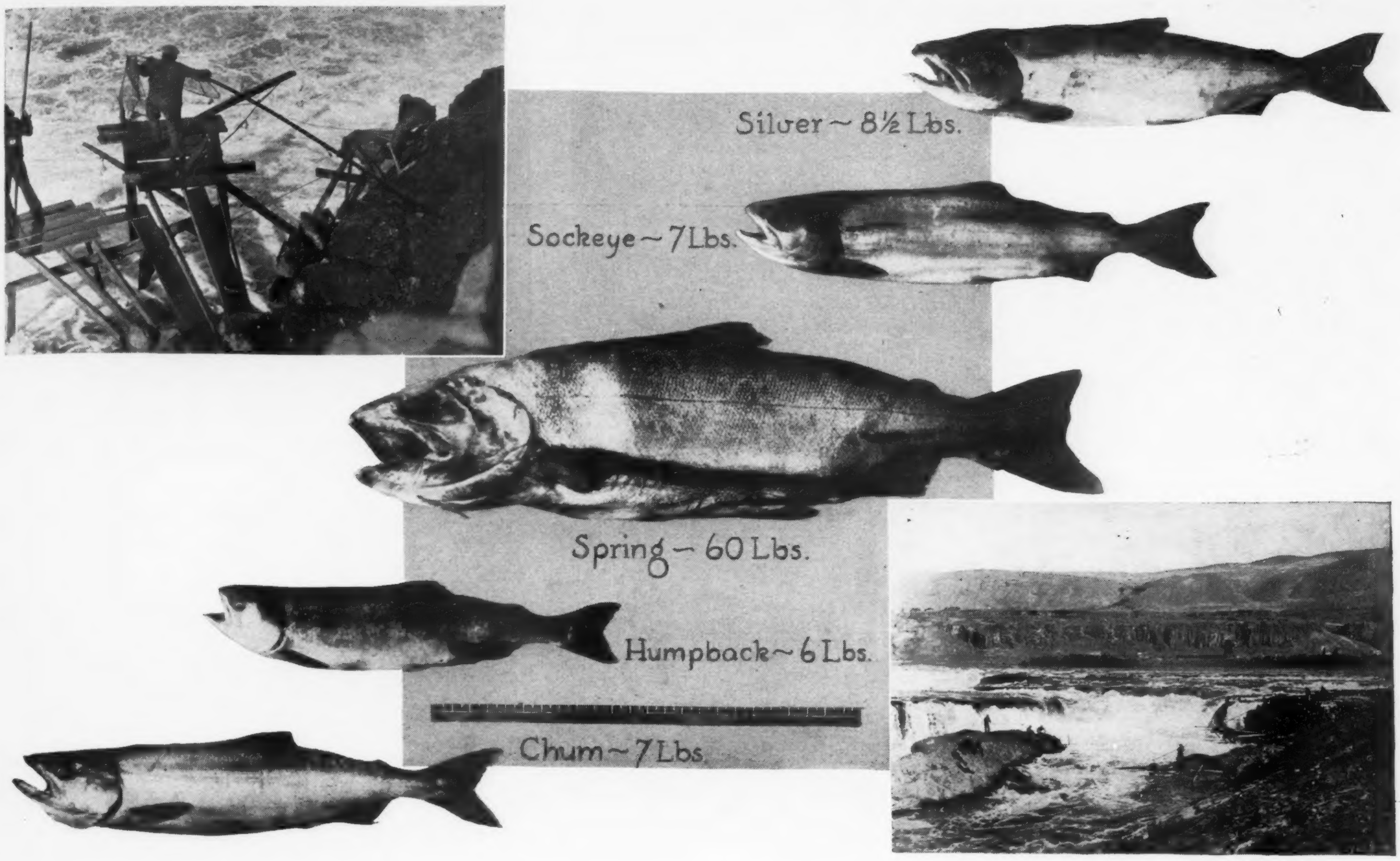
Pasteurizing and bottling room of Cushmont Farms, Lebanon, N. J. The tubular pasteurizer and cooler are near the center. At their near end, supported by metallic feet, is the filter. The cylindrical vessels at the right are holders for the heated milk. The bottling machine is at the extreme left. In the foreground is a roller conveyor for facilitating the movement of cases of bottled milk out of the plant.

Following pasteurization, which is described in connection with accompanying photographs, the milk is pumped by a piston-type sanitary milk pump through a Wisner-Peerless multiple-tube cooler, where it is cooled from 144° down to 38° F. Cooling to 70° is accomplished by using city water. Further cooling is effected by means of calcium-chloride brine, which is circulated at ten times the velocity of the milk with an Ingersoll-Rand No. 3 RVS Motorpump. The cooled milk is pumped to a balance tank directly above the bottle filler, which is automatically supplied with bottles by a conveyor from a Meyer-Dunmore Junior brush-type washer and sterilizer.

This plant handles from 30,000 to 40,000 quarts of milk daily. As an industrial plant it is a showplace. All piping is hidden, interior walls are of white tile and glass. Exterior walls are faced with white glazed brick. Virtually all metal apparatus is chromium plated. The company capitalizes upon cleanliness, and the plant is arranged so that visitors may readily see all phases of the operations. Through a glass partition they may observe the laboratory tests which are made at regular intervals. A large, attractively furnished room provides a place for the women of the community to hold social gatherings.

VARIATIONS IN CREAM LINE

Each bottle contains the same amount of cream. The variations in depth result from the differences in the shapes of the bottles.



LEAPERS OF FALLS

Literally translated, the Latin "salmo" means "the leaper." Thus the salmon is well named. It is probably the most important edible fish we have: certainly, in its preserved state, it is the most traveled. It saw service in France, where "Columbia River Turkey" was a byword with the American doughboys. Five commercially exploited species are pictured above, with the weight of each specimen and a 24-inch rule to indicate their relative proportions. In the lower corner is Celilo Falls, on the Columbia, where countless generations of Indians have waylaid the flashing hordes on their journey to the spawning areas. In the upper view a Warm Springs Indian of the present age is following the tradition of his forebears, but with the aid of a modern dip net.

Putting the Silver Horde into Tins

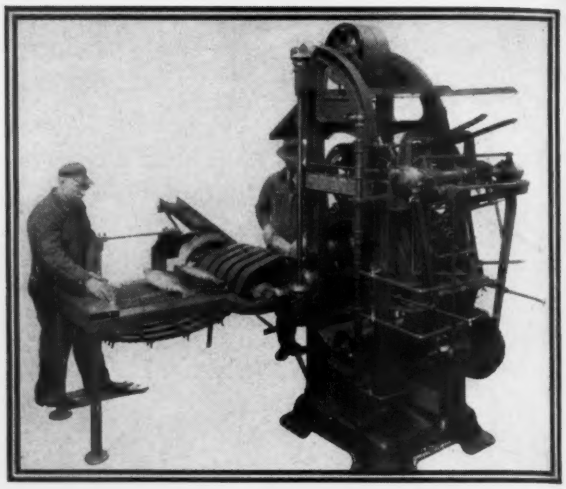
LAWRENCE A. LUTHER

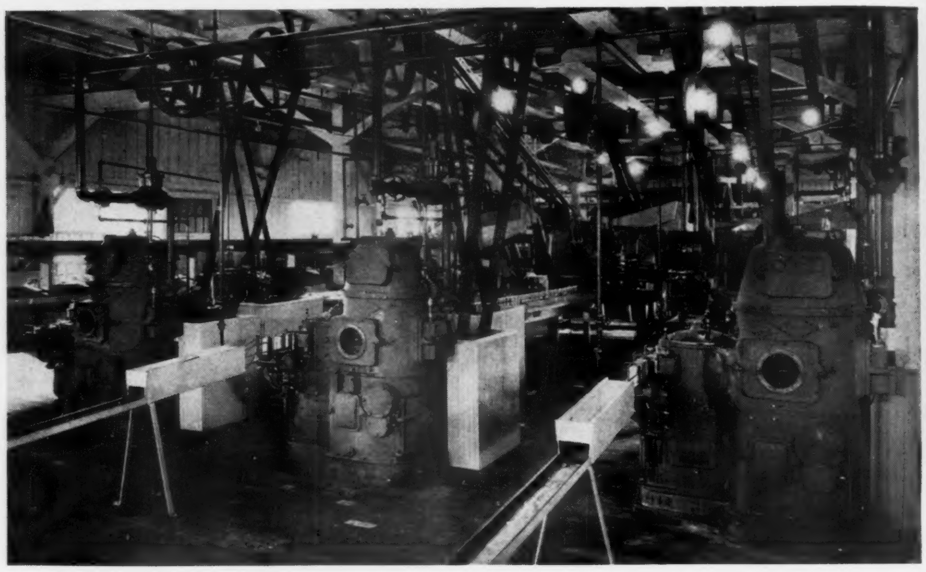
WHEN the warm winds of spring begin to pour melting snows into watercourses of the Pacific Northwest, millions of salmon in their ocean feeding grounds are reminded by an inscrutable telepathy we name instinct that they have a tryst to keep with Mother Nature in their distant native streams. If ultramodern biologists succeed in establishing the sea as the source of all life, we may in time find an analogy between our own peculiar sentiment for home town or farm and the persistence of the salmon in following their dim and perilous way to the headwaters of the Columbia or the Snake river. Just how far they range in their ocean haunts in transition from fry to mature fish remains somewhat a mystery; but we do know that nearly every stream entering the Pacific Ocean between Monterey Bay and Bering Sea has been having one or more runs of spawning salmon annually for a very long time.

Were our giant redwoods capable of recording general history instead of their autobiographies, they might be the means of giving us reliable data on the subject, as no native race of human beings has, to our knowledge, existed long enough to do so. We are safe in assuming that, even in that obscure past in which Homer sang his epics and the pyramids were building, silver hordes of Pacific salmon were rounding out their destiny and, incidentally, founding one of the oldest of American industries. Except perhaps for the great buffalo herds of the plains, no other natural source of food was so vital to the welfare of the thousands of aborigines that inhabited this great country of ours. The bear, the eagle, and many other denizens of the wilderness depended upon the spring runs of salmon to help them regain their physical fitness after enduring the hard northern winters. The little less savage human, after supplying his immediate needs, preserved the fish against a future shortage: and certain of the tribes, by packing a portion of their catch in woven hampers and using it to barter with other nations farther inland, became, in effect, exporters.

The Indians, in an area extending from the Arctic Circle to the land of the Shoshones, participated in this combined industry and sport; and we still find remnants of those red-skinned tribes fishing with bows and arrows from birch-bark canoes in the Yukon or plying their nets at Celilo Falls in the Columbia. The inland migration of the salmon was an event of the greatest significance to them—a harvest festival of religious as well as economic import. Their conception of the happy hunting ground envisioned a land in whose rivers the salmon were always running. Each tribe had its special *rendezvous* for fishing; and, with the exception of children, everyone participated. The squaws, always the more practical, seem to have contrived the most ingenious devices for snaring the fish. The catching and drying of a year's supply of pemmican—the oily, nutritious flesh and roe of the salmon—was to them an economic necessity, while their more dramatic but indolent mates, like all true anglers, fished for the sport of it.

Matchless fish stories are found in authentic accounts of salmon runs. We read of small streams so teeming with fish that they cannot be forded or even traversed by canoes. Kipling wrote with enthusiasm of his salmon fishing in the Willamette River; and the





BOATS AND MACHINES

Above is a salmon-fishing barge and its crew with a cork-floated gill net. At the upper right is the "iron chink," a quite incredible mechanical guillotine which removes heads, tails, fins, and viscera from 60 salmon a minute and splits each fish down the back into the bargain. It automatically accommodates its actions to fish of varying sizes. In the foreground of the view at the right are three vacuum closing machines, each of which exhausts air from 70 to 120 cans a minute and seals them tightly. These are similar in type to mechanisms used in packing coffee, corn, spinach, and numerous other articles of food.

disciples of Walton in the Northwest, through their several clubs, have offered gold, silver, and bronze medals for the taking of large specimens. To hook and to land a 50-pound salmon with a 6-ounce rod and other ordinary trout tackle is no mean achievement.

The Nordics that settled on the Pacific Coast took their cue from the native tribes and merely improved on existing methods of catching and preserving the fish. It formed an important part in the diet of the Russian colonists and traders in Alaska, and admirably served the Hudson Bay Company in its far-flung fur-trading activities. Lewis and Clark had gone but a little way westward from the Continental Divide before they discovered dried salmon to be the principal food of the natives and, themselves, largely subsisted on it during a lean winter.

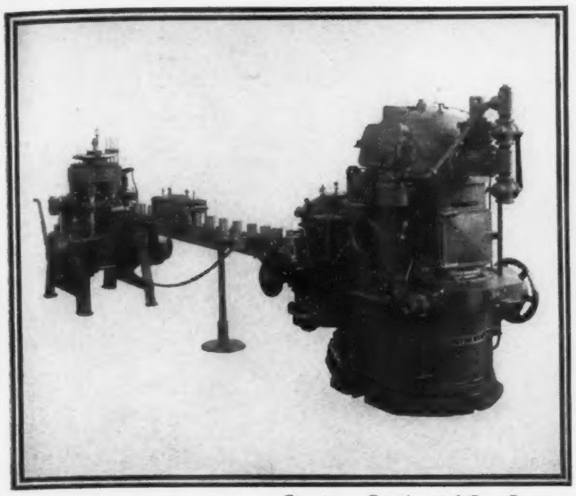
The Indian curer of fish did not know that his dessicated salmon was one of the foodstuffs richest in vitamins and essential salts, nor would he have been impressed by its iodine content. It is only of late that science has amplified our estimate of salmon as a wholesome food by pronouncing it to be among nature's most expertly compounded dietary offerings. Nearly all available iodine is contained in some form in the sea, from which the commercial product must be extracted. Iodine remains the most generally approved preventive and curative specific for goiter; and a generous inclusion of seafood in the diet, especially in localities whose water supplies are deficient in iodine, is finding increasing sponsorship in the medical profession.

Salmon, fighting their way upstream, sometimes through 2,000 miles of swift-flowing water, are remarkable examples of evolution. Like a Mohammedan approaching Mecca, they fast as they near their objective. It seems reasonable to suppose that this abstinence was originally enforced by the insufficiency of food which became more marked as the streams began to teem with spawning fish. In the salmon of today the digestive organs slowly shrink and atrophy to the point of being useless, so that, after leaving salt and brackish water, the oil content of the tissues must be depended upon entirely to supply the propulsive energy needed for the long, upstream journey.

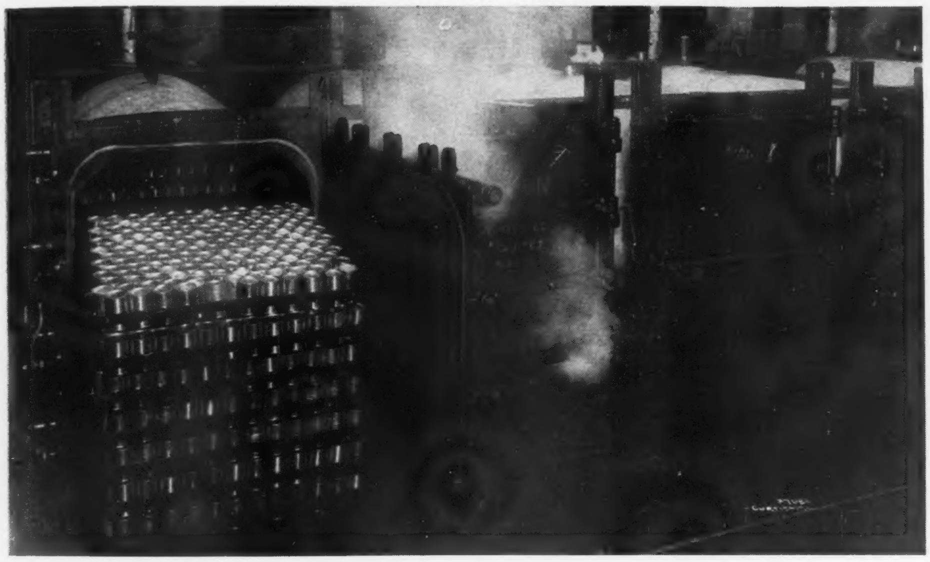
Our Federal Bureau of Fisheries has definitely set territorial limits within which it is permissible to fish for salmon on a commercial scale. None can be taken in streams or lakes which are so far from tidewater that to reach them would cause the fish to suffer a serious loss in fat and oil content. This agency has also instituted much legislation governing various phases of the catching and processing of salmon; and in the enactment of these laws the several state and territorial legislatures have expressed diversified, sometimes conflicting, opinions. Canada's equity in this great industry has, on occasions, served to complicate the judicial regulation of fishing in coastal waters contiguous to international boundaries.

Five distinct species of salmon are used commercially. Though there are many differences in size and texture, and some in quality and chemical content, the color of the flesh still remains the chief factor in determining price, although not to the same extent that it was during the early days of the canning industry. The brilliantly red sockeye salmon of Alaska, for example, took precedence over any product of a lighter hue; and some unscrupulous plants attempted by artificial means to give the latter the carmine coloring with which the sockeye is endowed by nature.

Rapid expansion and improvement in transportation facilities have made practicable the marketing of increasing amounts of each annual catch as frozen and as mild-cured fish; and modern refrigeration makes it possible to order fresh salmon with assurance in any first-rate restaurant in the United States or abroad. But nearly $50,000,000 worth of the fish, averaging about 6,000,000 cases, is packed on the Pacific Coast each



Courtesy, Continental Can Co.



FROM THE TRAPS

the agile salmon are unceremoniously dumped like so many sticks of wood into a barge (above) which transports them to a cannery. At the upper left is a vacuum can-closing machine. At its far end is the clincher, which puts the lids loosely in position. From there the containers pass to the larger unit, which completes the process of sealing them airtight. After being placed in the cans the fish are cooked in retorts, such as those pictured at the left. For easy handling the cans are piled upon trucks. Heat derived from low-pressure steam is maintained at 240° F. Cooking time varies, but averages 90 minutes.

year. This means that some 90 per cent of the total catch is put up in cans.

The first Pacific cannery, housed on a scow on the Sacramento River, was started in 1864. Containers were made slowly and imperfectly by hand in the off season and stored on the scow against the requirements of the next run. The cans thus turned out were so poor that nearly half of them burst when used. The cooking process was kept secret; and each tin, as a final preparation for the market, was hand washed and painted red in color. This infant industry did not produce, either in quality of contents or appearance of container, the sort of package we now expect and invariably receive from our grocer.

Commercial fishing is carried on in the sea, in bays into which streams frequented by salmon discharge, and in the lower reaches of such streams. Of the facilities in use, gill nets are the oldest and the most widely employed. They vary in length from a few hundred feet to nearly 2,000 feet, and are equipped in the conventional manner with cork floats on top and leads on the bottom. These nets are handled variously, depending upon currents and other local conditions. Haul seines are utilized on the lower Columbia, horses serving as motive power for these huge affairs that are nearly half a mile long. The Indian of today plies a dip net, not unlike the ordinary landing net provided with a long handle. Squaw nets—in effect, miniature gill nets—are, like their picturesque inventors, growing fewer in number each year.

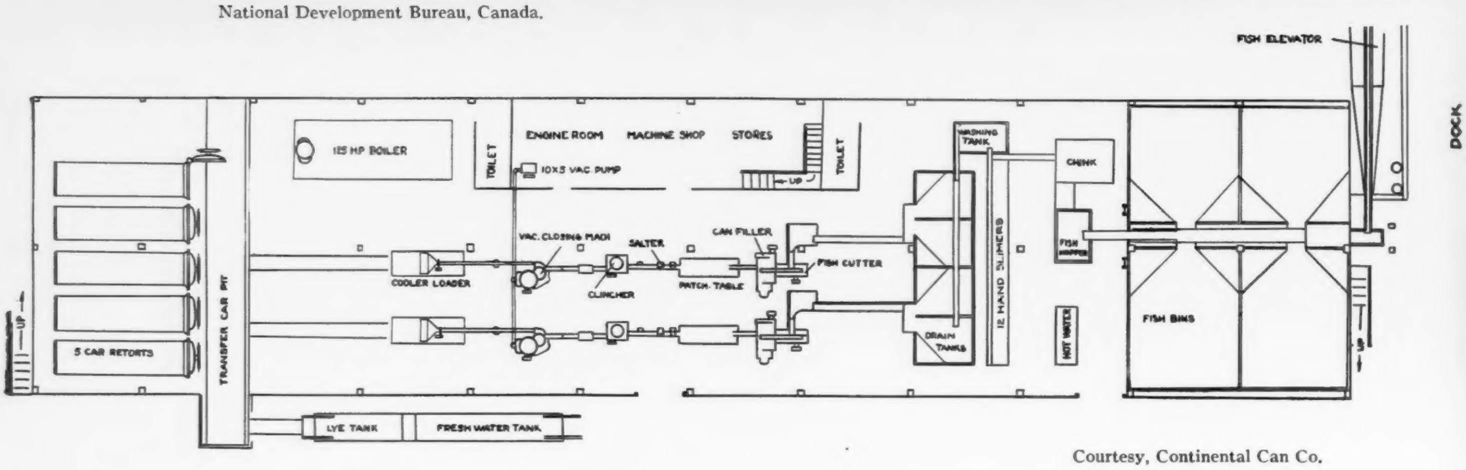
The use of purse seines involves some of the same spirited seamanship that is required in whaling. Fast boats equipped with them cruise in Puget Sound on the lookout for schools of salmon. The *modus operandi*, in brief, is to put off a dory to which is attached the other end of the long net; to surround the school with the net towed by the power boat; and then to draw it together like a gigantic bag by means of a purse line run through a series of rings.

The types of traps employed are legion. Some float while others are fixed, and many have one or two wings of netting—the shore serving as a third barrier in directing the fish into a labyrinth and, finally, into a chamber from which they are loaded into boats. Salmon wheels are operated both from floating bases such as scows and from fixed frames. Some of the latter, seen from the Columbia River Highway, represent investments amounting to several thousand dollars.

Canneries vary considerably in their equipment and methods, being governed in this respect by the location and the amount of the annual pack. In the case of the larger establishments, the salmon are unloaded from the fishing vessels on to an elevator float which mechanically delivers them to a horizontal belt conveyor discharging into a series of bins provided with suitable gates. Thence they are withdrawn, as desired, and taken by another conveyor to a fish hopper that feeds them to the first machine which, in cannery nomenclature, is designated the "iron chink." This thoroughly remarkable assembly of wheels and levers replaces the Chinese butchers of the early canneries, and is almost human in its actions. At the rate of one a second, it adjusts itself to each size of fish; severs the head, tail, and fins; removes the viscera; and splits the salmon. After a hand-washing, it is carried through a rinsing tank and then allowed to drain.

The fish are now ready for canning. Automatic machines cut them into pieces of suitable length, and these roll down a runway from an upper floor, receiving *en route* to the filler the proper quantity of salt. Tightly packed with salmon, the cans issue from the filler at a speed of from 70 to 120 a minute, passing over an inspection table between two lines of examiners who remove and adjust any can not satisfactorily packed. Moving on, the cans go first to what is called a clincher, which applies the covers loosely, and then to a vacuum closing machine in which, as the name implies, the cans are sealed under a vacuum.

National Development Bureau, Canada.



Courtesy, Continental Can Co.

FROM DOCK TO CAN

One floor of a typical salmon cannery is shown in plan form above. The fish are elevated from boats which dock at the right-hand end. The drawing shows the successive steps through which they pass before they enter the cooking retorts at the left end. From the retorts the cans are conveyed to the floor above (upper right) and there cooled before being labeled and packed for shipment. In the upper left is a boatload of salmon caught in the Skeena River, British Columbia.

In modern plants, vacuum pumps are generally employed to exhaust the air from the vacuum chamber, thus doing away with the older practice of depending for a vacuum upon the condensation of hot vapor within the cans after heating for some time by jets of superheated steam that play upon the containers as they move on conveyors within a large steam box. The vacuum produced mechanically is more uniform and complete. Its use also effects a considerable saving in time as compared with the steam box, in which the cans must be kept for about fifteen minutes in order to assure the right temperature for sealing. As this steam box is one of the bulkiest pieces of equipment in a cannery, much space is saved by substituting for it the compact mechanical exhauster. Some economy in power also results; but the paramount consideration is that of insuring the keeping quality of the product. Ingersoll-Rand Type 15 vacuum pumps lend themselves well to this work, and are in extensive use today.

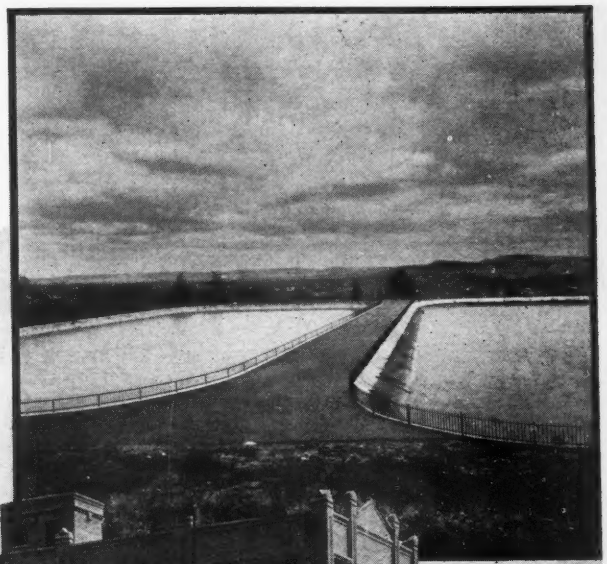
With the salmon packed and the cans sealed, the cooking process begins. The time it takes to do this and the temperature required are determined somewhat by the size and the species of the fish as well as by the dimensions of the can—the average treatment taking about 90 minutes at 240° F. Loaded several tiers high on cars that move over miniature railway tracks, the cans are carried into large retorts supplied with low-pressure steam. Following that they receive a chemical bath to remove any adhering grease; are dressed up for the market by lacquering or labeling, or both; and are then ready to be packed in cases.

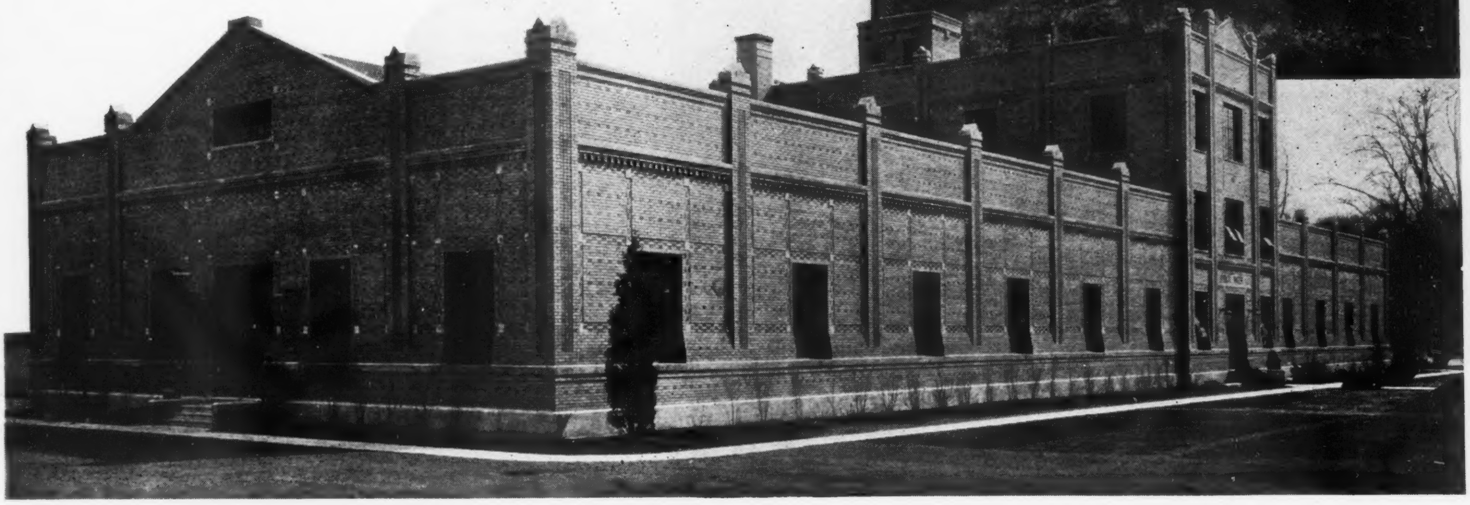
It is highly encouraging at the present time to find a national association of canners collaborating with federal and state agencies with a view towards improving the standard of the product and preventing the depletion of the fish, which represent at once its source of raw material and a priceless natural resource in which we all have a proprietary interest. The alertness and the thoroughly modern attitude of its leaders is strikingly evidenced by the fact that the association has recourse to exhaustive and expensive research. Elaborate equipment has been installed in a laboratory located in Seattle, Wash.; and the statistical data that are collected and tabulated represent a comprehensive analysis of the industry as conducted throughout the Northwest. Efforts to restock streams and to reduce the extent of the fishing in certain areas where the future supply of salmon is in jeopardy, can thus be coordinated and enforced. Everything possible is being done to foster artificial propagation of salmon in hatcheries; and to those that interest themselves in this phase of the activities there are available the results of past experience and experimentation.

We do not have to live in Seattle or Nome to take a lively interest in the welfare of this great industry. Alaska was purchased with funds from the national treasury; and we can therefore with reason consider all the coastal waters of the Pacific Northwest to be as much a communal possession of the United States as is New York Harbor or the Mississippi River.

Better Drinking Water For Easton, Pa.

ALLEN S. PARK





FILTRATION PLANT AND MAIN DISTRIBUTION RESERVOIRS

The building above houses the facilities for treating and filtering the water and also the pumps which elevate it to the main distribution reservoirs. The latter are shown in the smaller picture. Each of these twin basins has a capacity for 6,000,000 gallons of water. From them the water flows by gravity to most of the consumers. A few customers are on higher ground, and water for their use is pumped to another reservoir at approximately 175 feet greater elevation. In Wilson Borough is a third reservoir with a 120-foot standpipe in connection.

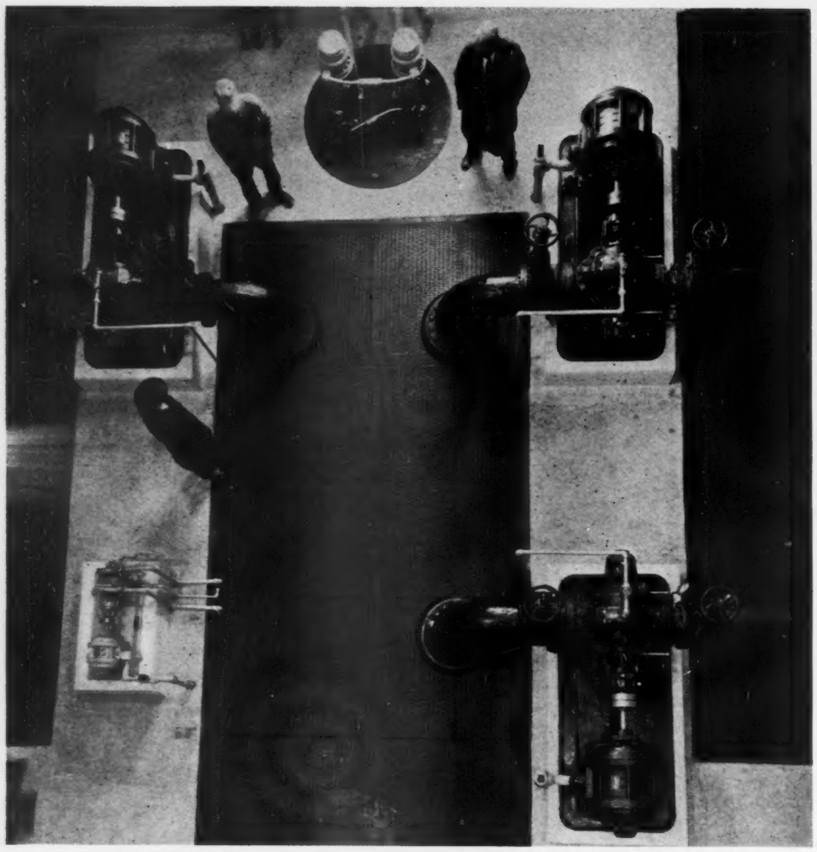
NOW, as always, the first concern of municipalities is the provision of an adequate supply of pure and palatable water. The proximity of water was a controlling factor in the location of early settlements. Streams were then in their natural state, and pollution was virtually unknown. The water problem was not a serious one with the pioneers, although it did involve considerable labor on their part: they had only to dip their buckets in the streams and carry the contents to their homes. During flood seasons the water was turbid and had to be clarified by allowing it to stand for a time before being used.

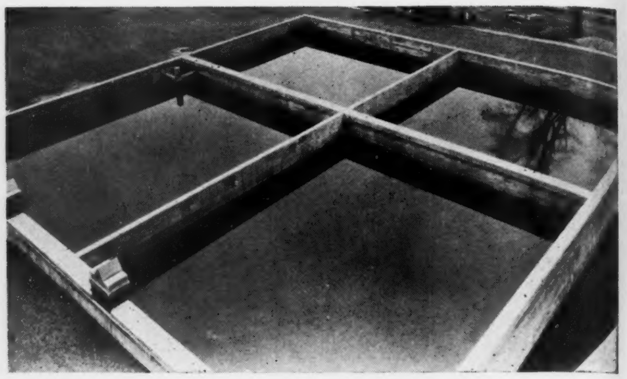
With the growth of population, more and more communities began to draw their water from the same stream, crude industrial plants were established, and the problem of water pollution arose for the first time. Because of this, and because it was more convenient for many individuals, a portion of the population then began to use well water. It was not long, of course, until the community system of supplying all the residents of a place from one source made its appearance. Public water supplies date back many centuries. There are records of the existence of wells in China, as deep as 1,500 feet, in pre-Christian times; and Joseph's Well at Cairo is said to have been driven a vertical distance of 297 feet in solid rock.

As nearby sources of water became inadequate or polluted, cities were obliged to go farther afield for this indispensable fluid. The Tiber River and local wells served Rome satisfactorily for many generations; but in the fourth century B.C. the water became unfit to drink and the city was compelled to provide other facilities for bringing in outside water. Appius Claudius constructed an aqueduct eleven miles long; and this structure was the forerunner of many similar ones built in subsequent years to supply Rome. We are told that by 305 B.C. there were fourteen of these water carriers, and that their combined length was 350 miles. Other aqueducts were constructed in Greece and India.

In our own country there are sections where streams are so abundant and where they have been polluted to such a small extent that cities of considerable size located on them are still able to secure from them ample water of satisfactory quality, and there has been no necessity of reaching into the hinterland. In some other cases, cities that are so fortunate as to be located near the junction of two rivers have been able, when one became polluted, to turn to the other for their source of supply. Easton, Pa., falls in this class. Its site is at the confluence of the Lehigh and Delaware rivers.

For many years Easton obtained water from the Lehigh through a system built by a private company which, for obvious reasons, took the name of the Lehigh Water Company. With further settlement of the region, the Lehigh Valley above Easton became the scene of extensive industrial development, and with the passing years the waters of that stream became less pure. The Delaware River Valley above Easton, on the other hand, met with little industrial development, and in consequence its waters suffered little contamination. It was, therefore, a simple matter for the Lehigh Water Company to change from the Lehigh River to the Delaware as the source of its supply. This was done about 1883. Delaware River water has been used since that time; and until of late its purity was such that very little treatment was required. Raw river water, with the addition of only chlorine, was pumped to reservoirs located high enough to permit gravity flow





TREATMENT BEFORE FILTRATION

Cameron pumps at the river level in the low-service station (left) pump raw water a few hundred feet into sedimentation reservoirs (the two smaller basins above) where heavy materials settle out. It then flows into one of two mixing channels (see opposite page) where paddles operated from a horizontal shaft thoroughly distribute chemical reagents. These materials—aluminum sulphate or filter alum, hydrated lime, and activated carbon—are introduced at a measured rate by the machines shown at the right just before the water enters the mixing channel. After half an hour of mechanical agitation, the water passes outside again into the coagulation basins (the two larger divisions above). Here, most of the gelatinlike floccules formed by the aluminum sulphate settle to the bottom, carrying with them minute particles of sediment and some bacteria. The water is then ready to be filtered.

through the mains, and was distributed to consumers after a brief period of settlement.

During recent years, however, it became increasingly apparent that modernization of the system was desirable. This step has now been taken through the erection of a completely new filtration and pumping plant. These works are models of their kind, and insure Easton a plentiful supply of fully protected and pleasant-tasting water for many years to come. The plant was designed by the hydraulic engineering firm of J. W. Ledoux of Philadelphia, and constructed under its direction. It exemplifies the latest approved practices in the chemical treatment and filtration of water; and the pumping equipment is noteworthy for its efficiency, economy, and reliability.

The water is taken from the river into what is known as the low-head pumping station, which is situated a few hundred feet upstream from the filtration plant. It is pumped to the main plant where, after a period of settlement, foreign materials are removed by chemical applications and by filtration. It is then elevated to the distribution reservoirs.

The company supplies Easton proper, the neighboring municipality of Wilson Borough, and a few customers in Forks Township on the north and in Palmer Township on the west. In normal times it has in service approximately 7,500 taps. Computed on the basis of the average number of persons served by each tap throughout the United States, it is estimated that the plant is taking care of between 35,000 and 40,000 persons. Until 1932, only about half the consumers were on meters, making it impossible to determine definitely how much water will be required normally. Since then all customers have been metered; but during the intervening period the industries of the city have been running at only partial capacity, and there has also been a tendency towards voluntary reduction in the use of water in homes because charges are now based on actual consumption.

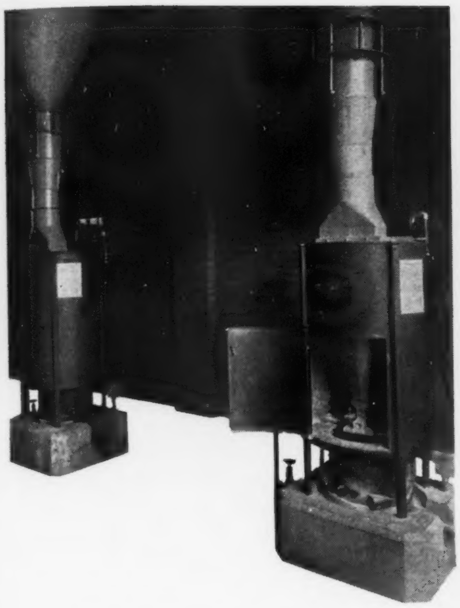
In designing the new plant, the normal average consumption was taken as 4,500,000 gallons per day, and the peak requirement was estimated at 7,500,000 gallons per day. The pumping installation consists of three units at each of the two pumping stations. Each of these units has a capacity of 4,000,000 gallons per day, thus providing a supply of 8,000,000 gallons per day with two pumps in operation at each station. This basis of operation leaves one pump in reserve at all times at each station. As a matter of fact, the present daily consumption ranges as low as 2,500,000 gallons. On this basis, two pumps at each station operating seven hours a day, or one pump at each station operating fourteen hours a day, can take care of the demand. Other units in the plant are equipped to handle the water on an equivalent basis; so it can be seen that the system was designed with great conservatism and that it can be expected to take care of the city's needs for many years under a normal rate of growth.

LOW-LEVEL STATION

Showing intake, and rip-rap to protect building from floods.

It will, perhaps, be of interest to the reader to follow the course of the water from the time it is taken from the river until it is delivered to the distributing mains. During the intervening period it spends approximately eight hours in the filtration plant. As previously stated, the intake is at the low-level pumping plant, where the water flows by gravity through bars, spaced 3 inches apart, into a suction well for the pumps. Before reaching the pumps it passes through a screen of ¾-inch mesh. There are two of these suction wells, which can be used alternately if desired. This provision of duplicate facilities is common to the entire plant, and was instituted both to insure reliability of operation and to permit the periodic cleaning and repair of essential units without interrupting the service.

Three Cameron No. 10 NFV centrifugal pumps, each rated at 4,000,000 gallons per day against a 50-foot head and driven by a direct-connected 50-hp. General Electric motor, pump the water through a 30-inch main from the low-level pumping plant to the filtration and treatment plant. It is delivered to a two-part, concrete sedimentation reservoir of 330,000 gallons capacity. In-



DRY-CHEMICAL FEEDERS

There are five machines like the two shown above. They are fed from hoppers on the floor above. A swirl of water is maintained in the lower part of each structure, and into this the chemical is introduced automatically and at the rate for which the feeder has been set. At the right are the two mixing channels, each with its set of four mixing paddles.

coming water must flow over baffles into the adjoining portion of the reservoir. It requires two hours for the water to pass through this reservoir, and this period of retention serves to settle out all but minute particles of sediment and organic matter. During a considerable part of the time the river water is of such clarity that it is unnecessary to impound it; and piping is provided for by-passing the sedimentation reservoir and delivering the water directly to the mixing channels, where chemicals are introduced. The plant is so constructed that the water goes through the entire treatment process by gravity.

Aluminum sulphate or filter alum, lime, and activated carbon are added to the water just prior to the time it enters the mixing channels—the nature and amounts of these depending upon the requirements of the incoming water as determined by analyses made at frequent intervals. These reagents, in powdered form, are stored in hoppers located above Wallace & Tiernan dry-chemical feeding machines which, upon proper setting, automatically apportion the amount of each substance which it is desired to add. The water, with the contained chemicals, passes into a mixing channel, which is a concrete basin holding approximately 80,000 gallons. Extending directly into this channel at four points in the course of its length are vertical shafts to which are attached metal paddles. These paddles are driven through gears by a horizontal shaft running along the top of the mixing channel and at the centerline. The mixing equipment is of the Harding type, and is unusual in that the four mixing units are driven from one source. Power from a 5-hp. motor is applied through a Reeves speed controller, which permits varying the speed of the mixers through a range of from 1 to 3 r.p.m. It requires approximately one-half hour for the water to pass through the mixing channel.

The purpose of introducing alum is to extract from the water silt and other fine particles which are too light to settle out by gravity. When placed in the water, the alum turns into numerous insoluble, spongy, colloidal bodies about 1/16 inch in diameter and somewhat resembling bits of cooked tapioca. These floccules are familiarly called "floc." The addition of lime creates the alkaline condition which is necessary for the formation of the floc. These small masses are very adhesive and, when thoroughly circulated throughout the water by means of the mechanical agitation of the paddles, serve to capture the suspended particles of solid matter. The floc also plays an important part in the process of filtration. The carbon, which is in an extremely finely divided form, has no part in the function of the floc and is added so as to prevent the water from having objectionable tastes and odors.

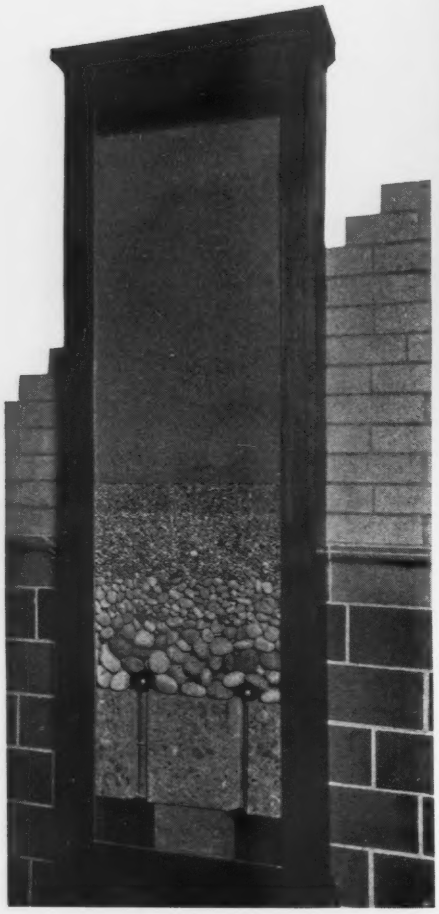
OLD PUMPING STATION

This now becomes a reserve unit after many years of service.

From the mixing channel the water flows into a coagulation basin, which is a two-part concrete structure of 500,000 gallons capacity and has baffles between sections. It requires about three hours for the water to pass through the coagulation basin.

The water flows by gravity from the coagulation basin to the filters. There are eight of these, arranged four on either side of the room, and only one side is used at a time. Each filter has a capacity of 1,000,000 gallons per day, and is built up of a 4-foot thickness of sand and gravel graded as to coarseness from bottom to top. The lower 18 inches of this layer consists of gravel made up of rounded particles which vary in size from 1½ inches down to 1/16 inch. This is overlain by 30 inches of Cape May beach sand. It requires two hours for the water to pass through the filters.

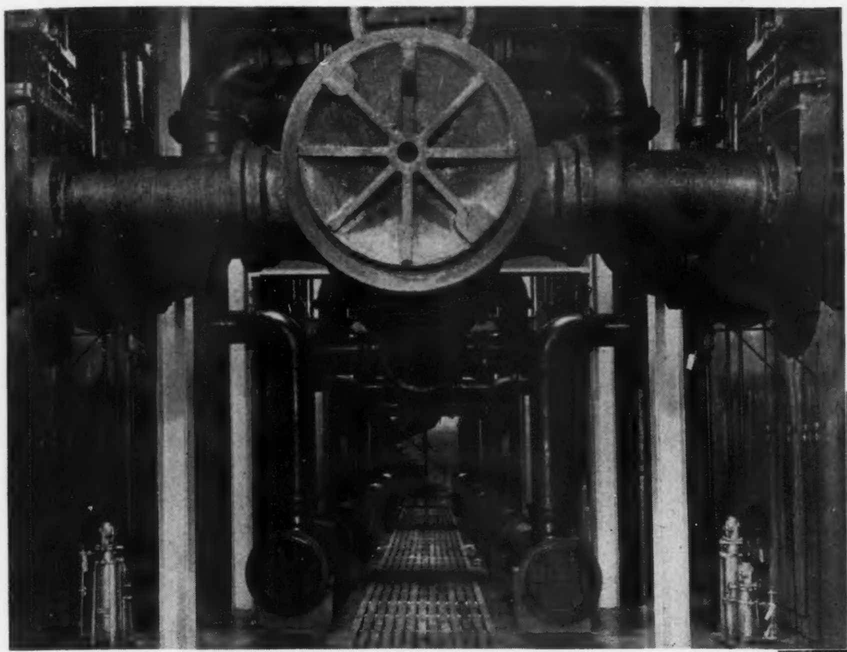
The presence of the alum floc in the water plays a very important part in the filtration process. Despite the fineness of the top layer of sand, the spaces between the grains are relatively so great that effective elimination of the minute particles of foreign matter and bacteria could not be accomplished through this agency alone. The jellylike floc serves to fill up the voids between the sand grains and forms a mat having openings so small as to capture virtually all of even the finest extraneous material. It is, therefore, im-



THE FILTERS

There are eight of these, four in a row at either side (below), with gauges and operating controls in front of each. An empty filter box is shown above. It is of concrete construction, 18 by 24 feet and 10 feet deep. Extending through the bottom are 840 small pipes each capped by a hemispherical "umbrella" which has openings on its under side for entrance of the water. On this bottom is laid 4 feet of gravel and sand. The water comes up through the bottom of the pit at the near end of the picture, rises, enters the metal channels, and overflows on to the sand. When the filter is operating at capacity, the water line is above the tops of the channels.

At the left is a section through a filter bed. It shows the gradation of the material upward from coarse to fine. Two of the drainage tubes are visible, one of them cut away to reveal its construction. For washing a filter, the customary flow is reversed and water is forced upward through the bottom. This serves not only to cleanse the bed thoroughly but also to regrade the material, which settles according to the weight and size of the pieces and particles after having been agitated by the force of the water.



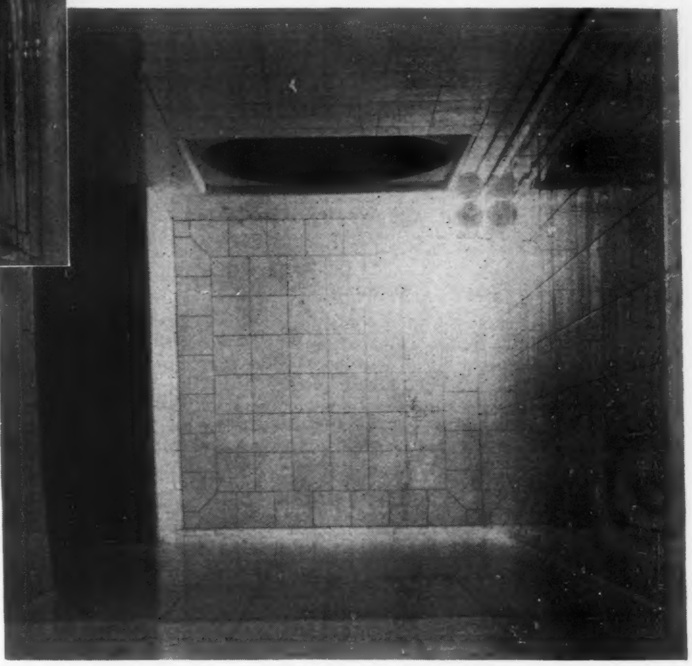
CAST-IRON JIGSAW PUZZLE

This is the pipe gallery. It occupies the space between the two rows of filters and beneath the floor shown at the bottom of the opposite page. The large pipe overhead brings the water from the coagulation basin, and the laterals deliver it to the filters. The smaller pipes along the floor on either side receive the water through feeder pipes after it has passed through the filters, and then deliver it to the far end where laterals direct it to one of two clear wells, concrete storage basins underneath the filters and extending their combined length.

Water for washing the filters is delivered from a tank on the third floor of the building by the pipe, of which only a portion of the end is visible, at the top of the picture. It passes to the filters through laterals. The flow through all these pipes is controlled, as desired, by merely turning the proper handles on the stands in the picture at the bottom of the opposite page. Water from the clear wells passes to the high-service pumps through a 30-inch pipe beneath the floor shown here.

CLEAR WATER

At first glance the picture below might be taken for a shower bath. The photographer turned his camera straight downward into the tiled observation well provided for inspection of the water after it has been treated and filtered. It is 18 feet to the bottom of this well, and the picture was made through 12 feet of water. The inflow is at the left, and the water discharges through the round pipe opening above the center. Illumination is provided by the electric globe shown suspended. This picture can be viewed best by looking directly down upon it.



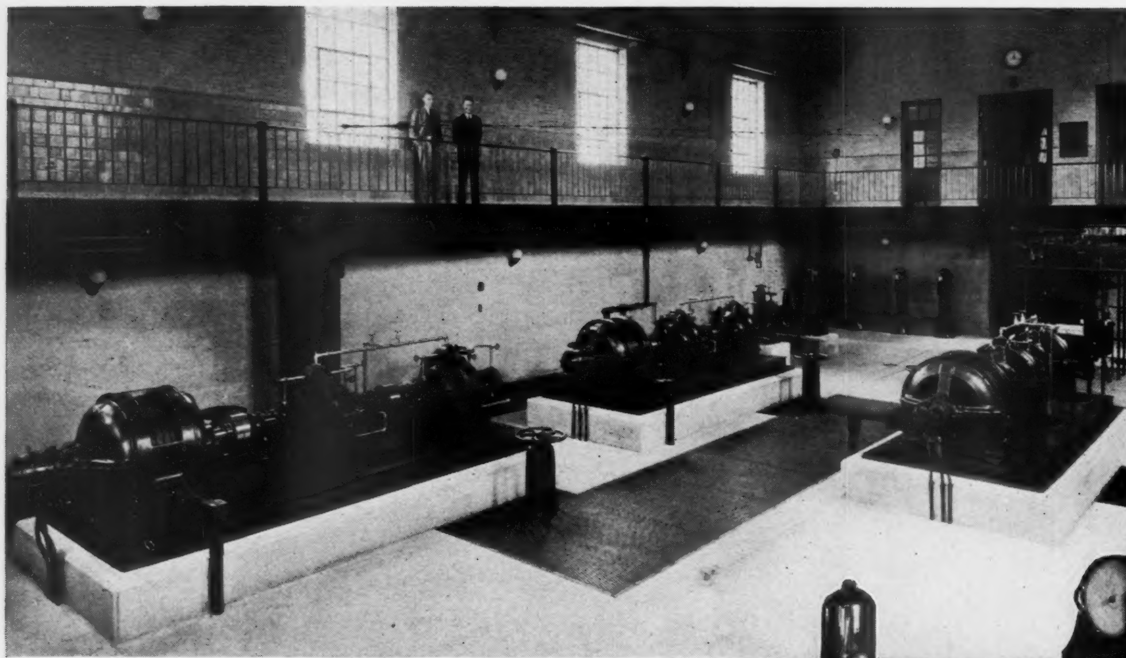
portant that some floc be allowed to pass from the coagulation basin to the filters.

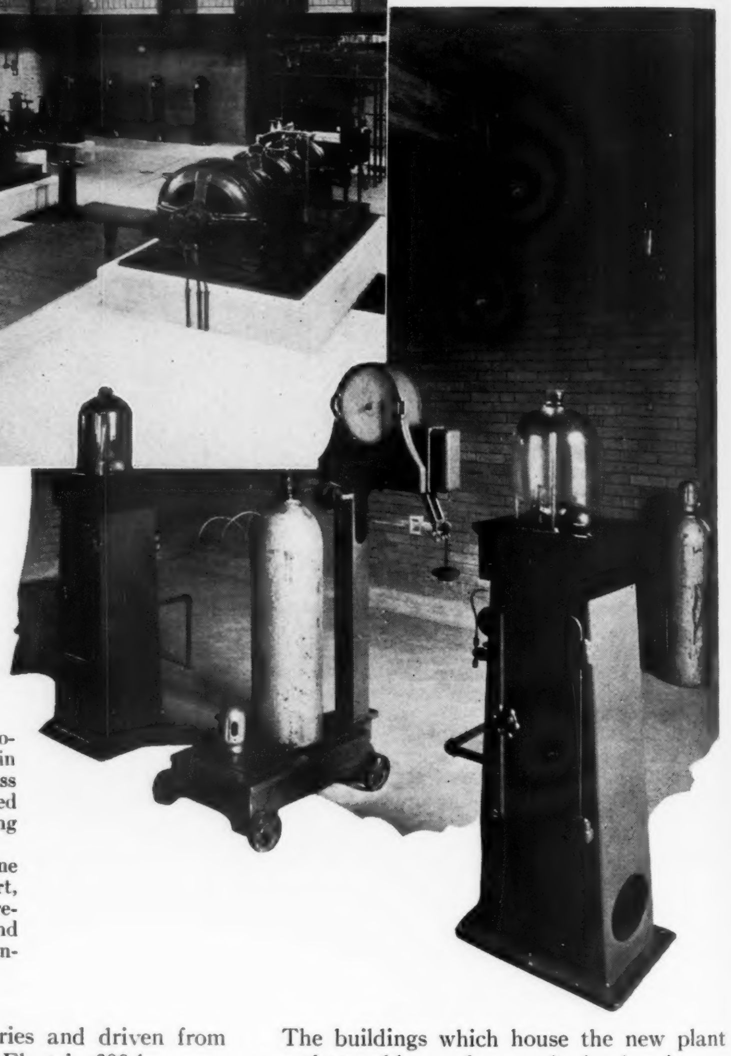
As the floc and the materials filtered out of the water continue to be deposited on top of the filters, a point is reached when the water will no longer freely pass through the mats. The performance of each filter is automatically recorded on Simplex gauges. When these show that the filters are becoming clogged, then the latter are shut down and cleaned. The cleaning is effected by forcing clear, treated water upward through the gravel and sand. This cleansing water enters the filters through the same pipe that normally serves as the discharge. The water for this purpose is stored on the third floor of the building in a circular, steel tank having a capacity of 50,000 gallons. This tank is filled by a Cameron No. 6 NFV centrifugal pump which has a capacity of 1,000 gallons per minute against a head of 62 feet and is driven by a 20-hp. motor. During the cleansing process, from 35,000 to 50,000 gallons of water is forced upward through the filters, carrying with it the floc, mud, and other accumulated material. During certain seasons of the year, when its introduction will not prove harmful, it is emptied directly into the river. At other times, particularly in the summer when the river is used for bathing, the wash water runs into a sump, from which it is pumped into a sedimentation basin where the suspended material is allowed to settle out. A Cameron No. 6 NFV centrifugal pump, rated at 1,000 gallons per minute against a 30-foot head, is used for this pumping service.

The filters are placed over a false bottom, and underneath them is a huge reservoir known as the clear well. The water does not pass directly from the filters into the clear well, but emerges through pipes on the side of each filter into a 20-inch header in the pipe gallery, which occupies the subfloor section between the two rows of filters. This header directs the water to one end of the pipe gallery in order that it may be given desired chemical treatment before entering the clear well. A Simplex level-control system is provided by means of which the flow into the clear well is automatically shut off when the height of the water in the well reaches a certain point. This raises the level of the water in the filters, and when this reaches a certain point the flow to the filters is, in turn, automatically stopped.

Chlorine is added to the filter water at the effluent or discharge end of the clear well as a precautionary measure to render sterile any bacteria which may have passed through the filters. Before the construction of the new plant, when the water was not filtered, chlorine was used in considerable amounts and became objectionable because of the taste that it imparted to the water. This objection has now been overcome, as it is necessary to add only small quantities of chlorine. The actual amount varies according to the conditions that obtain, but averages not more than 4 pounds to every 1,000,000 gallons. To prolong the bactericidal effects of the chlorine and also to correct the taste of the water, ammonia is added at the influent or inlet end of the clear well.

En route from the clear well to the pumps, which discharge it from the plant, the water passes through an observation well which reveals its crystal-like clearness. There the visitor may stand on a glass top, peer through 12 feet of water, and read the name of the company inscribed in small letters on the bottom of the well. Every possible provision has been made for checking the purity of the water. A laboratory is maintained in which there is installed the most modern equipment obtainable for physical and chemical examination. The daily-routine analyses consist of from 30 to 40 tests of both chemical and bacteriological natures and include examinations for acidity, alkalinity, carbon-





HIGH-SERVICE PUMPS

These Cameron, centrifugal pumping units (above), each driven by a 300-hp. synchronous motor, elevate the filtered water 265 feet to distribution reservoirs on a hill overlooking most of the city. The 30-inch suction line to the pumps runs beneath the floor. One of the 24-inch discharge lines is shown rising at the left. The four pedestal gauges in the far corner record the performance of these pumps and of the wash-water pump which is located in front of the gauge at the left end.

THE FINAL SAFEGUARD

From 90 to 95 per cent of the bacteria is removed from the water by coagulation and filtration. To complete the sterilization, chlorine is added in required quantities as determined by periodical analyses, but never in excess of a few parts per million parts of water. The machines shown at the right feed liquid chlorine continuously at any desired rate, the recording gauge registering the loss in weight of the flask throughout the 24-hour period.

Objectionable tastes and odors which commonly result from introducing chlorine are corrected by adding activated carbon, an element which, though chemically inert, exercises the desired influence. The amounts of all chemicals used are varied frequently in accordance with their need as disclosed by some 30 or 40 chemical and bacteriological analyses daily. Tests are made for alkalinity and acidity, carbon-dioxide content, hardness, and bacteria count.

dioxide content, and hardness. With these facilities, the company is able to maintain exceptionally close control over the character of the water delivered. Analyses show that the degree of hardness is only 32 parts per 1,000,000, and that the amount of the chemicals actually reaching the water taps is so small as to be negligible.

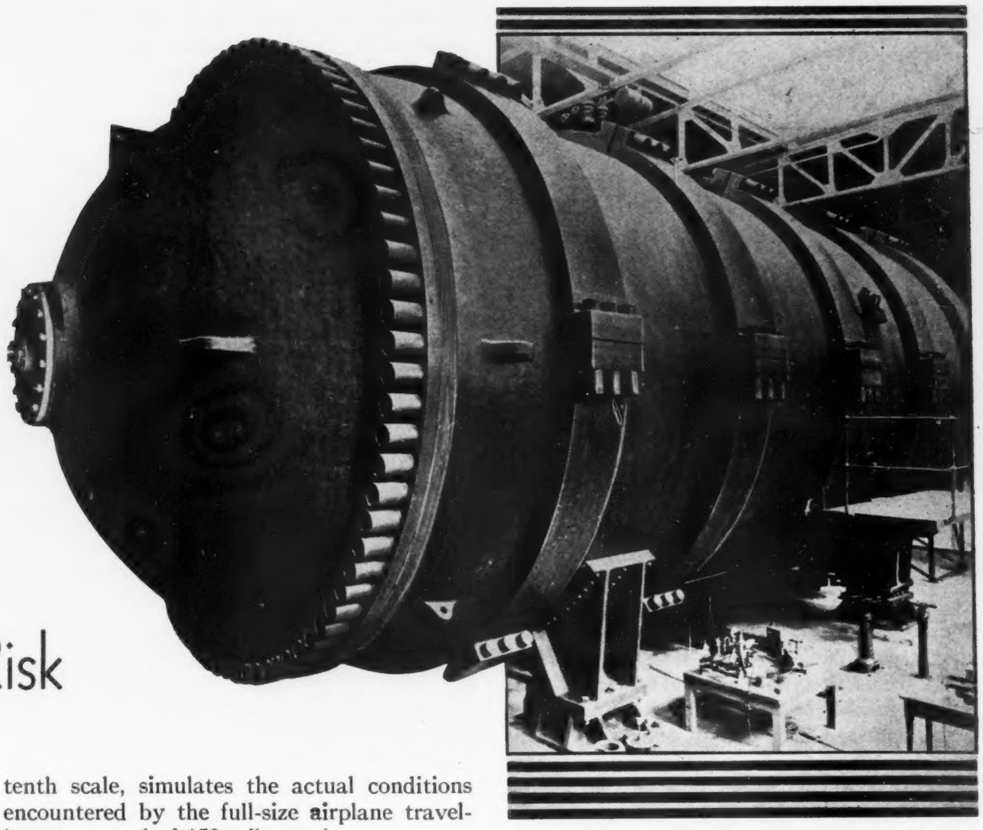
After the water is filtered, it passes through a 30-inch suction line to pumps which elevate it approximately 265 feet to two 6,000,000-gallon reservoirs situated on a hill overlooking most of the city. Less water is pumped to a small reservoir, 173 feet higher up, which serves a few consumers above the elevation of the two main reservoirs. From the main reservoirs the water flows through regular discharge mains into another reservoir in Wilson Borough over a mile away. Pumps at that point elevate it to a standpipe 120 feet high.

Each of the three main pumps at the new plant which give the water its initial elevation to the main reservoirs has a capacity of 4,000,000 gallons per day against 304 feet of head. These three pumping units are of the Cameron No. 10 SHV type, and each unit consists of two single-stage double-suction pumps operating in series and driven from one end by a General Electric 300-hp. synchronous motor. Both pumps of each pumping unit have a bottom suction nozzle and a bottom discharge nozzle, so that the water is discharged from the first pump and delivered to a U-shaped pipe connection, which leads upward to the suction of the second pump. This sweeping bend reduces friction, requires only a short length of pipe, and makes for neat appearance by enabling all piping to be concealed. Each pump, with its driving motor, is mounted on a welded steel base plate which is supported on its foundation at the edges only and without the use of any structural reinforcement below. This leaves the central portion of the interior of the foundation open, providing a means of ready access to the piping while maintaining the neat appearance of the installation. Each pump in these series units has its own Kingsbury thrust bearing; and the driving union between stages is a flexible coupling. The impellers and fittings are bronze, and the casings are cast iron. These features of construction, and the conservative speed of 1,200 r.p.m. at which the pumps operate, insure durability, dependability, and low cost of maintenance.

The buildings which house the new plant are thoroughly modern and pleasing in appearance. The low-level pumping station was constructed under a general contract with Collins & Maxwell of Easton, Pa. The general contractor for the filtration plant and high-level pumping station was Turner Construction Company. General Electric Company installed the substation equipment and switchboard. All filtration apparatus was supplied by the Norwood Engineering Company of Florence, Mass. George L. Bean of Philadelphia, representing J. W. Ledoux, directed the various activities entering into the construction.

The plant requires only two men per shift for its operation, and the personnel of the old plant runs it. R. W. Haywood is superintendent of filtration, and W. B. Johnson is general superintendent for the water company. The officials of the Lehigh Water Company, who are responsible for the new facilities that have brought the water-supply system of Easton to a high standard, are: Asher J. Odenwelder, Jr., president; Charles R. Rodenbough, vice-president; Leah G. Wolbach, secretary; and W. Bruce Drinkhouse, treasurer.

Testing Airplanes Without Human Risk



Photo, Acme

WHERE TOY AIRCRAFT WILL BE FLOWN

Within this huge 350-ton steel drum at Teddington, England, a 60-mile wind will be created in air that is compressed to 350 pounds pressure, thereby simulating conditions met by airplanes when flying 150 miles an hour in atmospheric air. Here model planes will be tested to determine the behavior of their larger counterparts in actual flight. Instruments outside the tunnel will give observers essential data on what is taking place inside. It is believed that this high-pressure cylinder will reveal with more accuracy than possible heretofore any faults in design or weaknesses in full-size craft so that they can be corrected before the airplanes are built or leave the ground, thus greatly reducing the hazards of flying.

MAN-MADE hurricanes blowing at a velocity of 60 miles an hour are being produced by the aid of compressed air in the model-experimental tunnel of the National Physical Laboratory at Teddington, England. This high-pressure wind tunnel is the newest addition to the laboratory's Aerodynamics Department, and is designed for the testing of miniature airplanes or parts of airplanes. In it it is possible, because of the use of compressed air, to determine far more closely than ever before just what the full-size counterparts of those models can be counted upon to do in actual flight. In the case of the older types of wind tunnels there is frequently a marked difference between the model results and the results obtained with the full-size machines. Let us quote what the London *Engineer* has to say on this point, it may make it clearer to the lay reader:

"Model tests yield results which must be interpreted in the light of the Reynolds number appropriate to the conditions under which the tests are carried out. The Reynolds number is a factor proportional to the linear dimensions of the model, to the velocity of the fluid in which it is tested, and to the density of the fluid, and inversely proportional to the viscosity of the fluid. The theory is that model tests will yield results from which the full-scale performance can be deduced if the Reynolds number for the model tests is the same as that for the full-scale conditions. In ordinary wind-tunnel tests that equality does not hold. By carrying out the model tests in a current of high-pressure air a much closer correspondence is obtained."

The tunnel, itself, consists of a steel shell of great strength, enabling tests to be made in air at many atmospheres pressure instead of in air at normal pressure. Within it can be attained a wind speed of about 60 miles an hour at a pressure of 25 atmospheres—a wind which, blowing against a model of one-tenth scale, simulates the actual conditions encountered by the full-size airplane traveling at a speed of 150 miles an hour.

The shell is 50 feet long, has an internal diameter of 17 feet, and is about 2½ inches thick. It was built in Sheffield by John Brown & Company, Ltd., and consists of four seamless, rolled rings, joined by a special form of butt strap, and of two hemispherical ends each of which is made up of two steel castings held together by a suitable flanged and studded joint. When the tunnel is fully charged with air at a pressure of 350 pounds per square inch, these end castings will in each case be subjected to a pressure of more than 5,000 tons. Complete, the structure weighs 350 tons. So large are its component parts that they could not be shipped in the regular way but had to be hauled on special "crocodile" trucks for a distance of more than 100 miles during the hours of night when traffic would be least interfered with. Upon reaching its destination, the tunnel was set up, and the building now housing it was constructed around it.

Inside the pressure tunnel is a smaller tube and a working section with a diameter of 6 feet. Air is forced through the tube into this section and permitted to escape by way of an annular passage surrounding it. The air is supplied by three 400-hp. compressors. These machines are installed in an adjoining room and, together, are capable of charging the shell to the full pressure of 25 atmospheres in about an hour and a half. The air is kept circulating by a metal screw, which is also driven by a 400-hp. motor, and is fastened at one end of the inner tube. At the other end of the tube is a honeycomb or grid which serves to smooth the air flow before it passes through a rapidly contracting jet into the working section. The model to be tested is suspended in the center of this chamber; and all the measurements are recorded on apparatus outside of the pressure tunnel by means of electric balances especially designed for the purpose.

Miniature sections of airplane wings, such as are commonly used in the construction of British flying machines, are to be the first to undergo testing in the new wind tunnel. Next will follow an interesting experiment which will determine the effectiveness of the apparatus. An airplane model and its full-size counterpart are to be tested simultaneously—the former in the tunnel and the latter aloft at the Royal Air Force field at Farnborough. The results obtained in the laboratory will be compared with those obtained in actual flight, and the authorities at Teddington are confident that they will be identical. The expectations are that there will be less occasion in future to expose men and machines to the risks of experimental flights.

FREDERICK WILLIAM PARSONS

FREDERICK William Parsons, vice-president of Ingersoll-Rand Company and manager of its plants at Painted Post, N. Y., and Athens, Pa., died April 1 at his home in Corning, N. Y., after an illness of several weeks. He would have been 67 years old in July.

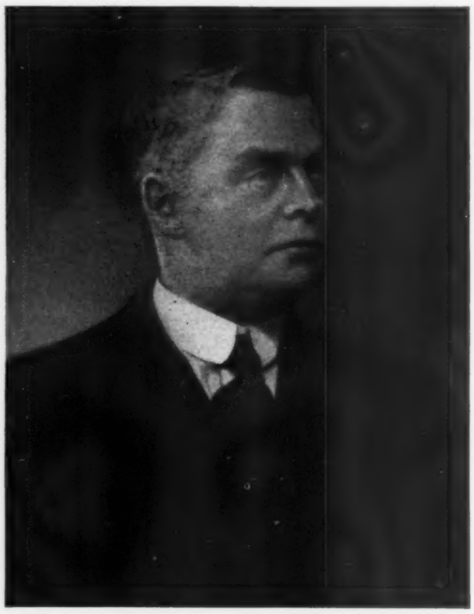
Mr. Parsons spent within one year of a half-century in the machinery-manufacturing field. For 39 years he had been identified with Ingersoll-Rand Company or with some of the concerns through whose consolidation it was formed. Throughout this connection, his influence was an important one in the development of the company's products. Many improvements in machinery, particularly in compressors, were accredited to him. Along with his bent for mechanical design, he possessed pronounced abilities as an organizer and executive. These attributes, coupled with a dynamic personality and a remarkable capacity for work, enabled him to fill positions involving manifold duties.

Mr. Parsons was born in Corning, spent his childhood there, and in 1884 was graduated from the Corning Free Academy. He had intended to enter college; but having joined the staff of the Payne Engine Company in Corning he became engrossed in the study of draftsmanship under Benjamin Payne and remained with the firm ten years. During the course of that service the firm's activities were transferred to Elmira, N. Y., and he moved there.

In 1894 he went to Ossining, N. Y., as superintendent of the foundry of the Rand Drill Company. He remained there until 1898, when he induced his employers to purchase the Weston Engine Company in Painted Post, that concern having been placed on the market following the death of Abijah Weston, its owner. The Imperial Engine Company was organized to operate the plant, with Jasper S. Rand as president and Mr. Parsons as treasurer. The company turned its attention to the manufacture of air compressors, and shipped its first machines of this class in November of 1899. This was the beginning of the "Imperial" line of compressors, which has since become well known throughout the world.

Mr. Parsons had in the meanwhile been adding to his store of knowledge and experience in the manufacture of machinery, and had been continually broadening his influence in shaping the course of engineering designs and factory management. The scope of his duties widened still further in 1901, when he became manager of the Rand Drill Company's factories at Ossining and Tarrytown, N. Y., and of the allied Imperial Pneumatic Tool Company at Athens, in addition to retaining his direction of the Painted Post works. At this time he moved to Tarrytown.

In 1905, following the formation of Ingersoll-Rand Company, he was assigned the management of the Painted Post, Tarrytown, and Athens plants. He took up residence in



FREDERICK WILLIAM PARSONS

Elmira, N. Y., and it is related in evidence of his zeal for industry that for many years he daily took a train from there at 6:30 o'clock in the morning in order that he might be on the job in Painted Post by 7 o'clock. He continued to make his home in Elmira until 1928, when he removed to Corning.

Under Mr. Parsons's guidance, the Painted Post plant grew from a small industrial establishment to the largest factory in the world devoted exclusively to the manufacture of compressors. The population of the town increased fourfold as a result of the employment the factory made possible.

In a quiet, unobtrusive way, Mr. Parsons aided many civic movements in Corning and Painted Post. He was keenly interested in housing developments for employees of the company, and carried out a plan under which ground was acquired and laid out and upwards of 200 homes built. He freely supported community charities and local undertakings looking to the betterment of the locality. He was a director in the First National Bank & Trust Company of Corning. His social life included membership in the Elmira Club, Elmira Country Club, Corning Club, and Corning Country Club. He was instrumental in extending the golf course of the last-named organization and gave material assistance in the laying out and construction of an additional nine holes. He was also a member of the Engineers' Club of New York and of the American Society of Mechanical Engineers.

Mr. Parsons's first wife died in 1914. From this union were born three children: Henry Parsons, of Great Neck, N. Y., a vice-president of Nitrate Agencies Company; Frederick W. Parsons, Jr., of Corning; and Charles L. Parsons of Painted Post. The two latter are employees of Ingersoll-Rand Company. Mr. Parsons is also survived by his second wife, Mrs. Lyda Knapp Parsons.

Funeral service was held on April 3. Burial was at Corning.

INTERESTING DEVELOPMENTS IN PAPER-MAKING

MIRROR paper and zinc paper are the newest products of the research laboratory, and each depends upon a mineral for its special characteristics. The first mentioned is made by the Reynolds Metals Company and is an insulating material. It consists of waterproofed Kraft paper both sides of which are covered with metal foil protected by a thin and transparent coat of a suitable oxide. These bright surfaces reflect heat just as a mirror reflects light, and thus gives the material high insulating properties. It comes in rolls, and is used for building purposes.

The second product is a very thin and opaque paper intended for general commercial use. It is the result of efforts made by a mail-order house to cut down the weight of its catalogues primarily to save postage. At the suggestion of this particular concern, the New Jersey Zinc Company set about determining if zinc pigments, which are white, could be depended upon to do for paper what they now do so effectually for paint—that is, make it opaque. The point was that the paper-making industry could not furnish the mail-order house with a thinner paper that would be sufficiently opaque to prevent the ink from showing through.

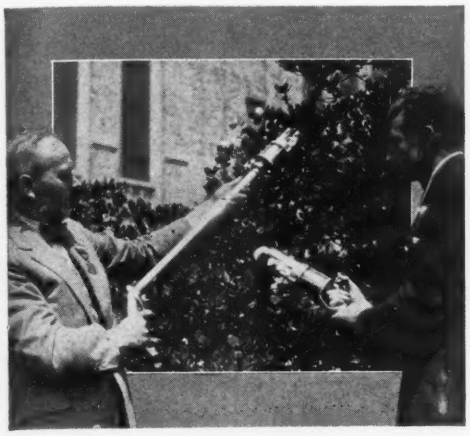
After nine months of collaboration with the Institute of Paper Chemistry at Appleton, Wis., the chemists of the New Jersey Zinc Company have, according to a recent announcement, succeeded in producing zinc pigments that possess the desired qualities. Numerous test runs in commercial mills are said to have verified their findings—namely, that the pigments give thin papers more opacity than they have ever had before; that they impart a brilliant whiteness to them; that they do not weaken the sheet; and that they are mildly antiseptic and therefore prevent the growth of slimes in the pipes and vats. Three brands of the pigment are being offered to the trade: XX Zinc Sulphide, Cryptone, and Albalith, each suited for certain kinds of paper.

Manufacturers are very much interested in the latter developments, and predict some important changes of vital interest to their customers if the results of the test runs can be duplicated on a commercial scale. A hint as to what may be expected is given by the mail-order house in the statement that the use of zinc paper will in all probability enable it to save the tidy sum of $35,000 each time it sends out its catalogue. That will be its reward for pursuing a matter that the paper companies, themselves, had apparently not been able to solve.

AIR-OPERATED PRUNING KNIFE

LARGE-SCALE pruning in the modern way is done mechanically—that is, by a pneumatic pruner that has been invented recently by a Californian. Described briefly, the tool consists of a hollow aluminum rod carrying a brass cylinder and a steel knife and hook. High-pressure air, entering by way of the rod, causes the cutting mechanism to operate—the air being drawn from a tank through a connecting hose screwed into the lower end of the tool.

In service, the branch to be pruned is caught in the hook, and air is admitted to the rod by pushing a trigger set in the handle.



PRUNING WITH PNEUMATIC KNIVES

Under a pressure of 175 pounds per square inch the knife is forcibly thrown forward, passing the hook ¼ inch so as to assure a clean cut, one that will sever the limb from the tree. By shutting off the air supply, a steel spring in the cylinder restores the knife to its normal position.

As the accompanying illustration shows, the pruner comes in two designs: the long one the inventor is pleased to call an orchard pruner and the short one a vineyard pruner. The only essential differences are that the former can be lengthened by attaching extension rods so that every part of a tree can be reached without the use of a ladder and that it carries 50 feet of hose, while the latter is provided with a hand grip and has but 25 feet of air line. This is sufficient to enable a workman to prune three rows of vines on either side of the truck on which the compressor and air receiver are mounted. The extension rods are made of aluminum so that the tool will not become heavy and unwieldy.

Little practice is needed to learn to handle the tool with facility; and as it relieves the operator of all physical effort he can accomplish far more in a given time than with the ordinary pruning knife. It is said that with the air-driven tool a skillful worker can make as many as 125 cuttings a minute.

SOLUTION APPLIED UNDER PRESSURE SEALS POROUS CASTINGS

SWEATING or leaky castings can be reclaimed and made as good as new, according to the Bakelite Corporation, by the use of a sealing solution that has been put on the market by that company. Exceptional qualities are claimed for the product, namely: It does not melt or dissolve after proper treatment; is unaffected by hot or cold water, steam, or heat up to 400° F.; and is resistant to most chemical reagents. It is recommended, however, that the manufacturers be consulted before applying the solution to fittings designed for the handling of chemicals.

The liquid seal is forced into the pores of the otherwise perfect metal part at a pressure not exceeding 250 pounds per square inch, after which it is baked from one to two hours in an oven at a temperature of from 275 to 300° F. Aluminum, nickel, silver, bronze, brass, and other castings that come up to specifications in all other respects can thus be made tight and will pass the most exacting inspection and test. The solution is not recommended, however, for use on second-quality goods.

BRIDGING THE MISSISSIPPI AT NEW ORLEANS

WORK has been begun on a combination railway, highway, and footway bridge across the Mississippi River at a point about nine miles upstream from the business district of New Orleans, La., marking the successful outcome of a project that was proposed back in 1931 by the New Orleans Public Belt Railroad Commission. The scheme had to be abandoned at that time because the funds necessary to finance the several contracts that had already been let could not be raised through the regular banking channels. The construction of the great span is now being made possible through the Reconstruction Finance Corporation, which is advancing $7,000,000, or more than half of the estimated cost of $13,000,000. The balance is being taken care of by the promoting interests.

The Public Belt Bridge will be of the cantilever type with a 790-foot main span and 530-foot anchor spans. It will have a length of more than 3½ miles including its approaches, and a maximum clearance at high water of 135 feet so as not to obstruct navigation. From an engineering standpoint, the building of the foundations will represent the most difficult part of the entire undertaking, because the piers will have to be sunk to a depth of more than 150 feet below low-water level. Contract for this work has been let to the well-known firm of Siems-Helmers, Inc., of St. Paul, Minn., who have had much experience in underwater operations of this kind. The substructure for the approaches is being built by the MacDonald Engineering Corporation of Chicago, Ill. Modjeski, Masters & Chase, of New York City, are the designing and construction engineers.

Of interest at this time is the fact that the bridge will give direct employment to 2,000 men and that an additional force, estimated at 4,500, will be required to provide the necessary building materials, including 60,000 tons of structural and reinforcing steel, 200,000 cubic yards of concrete and masonry, 4,000,000 feet of lumber, and 1,200,000 feet of piling.

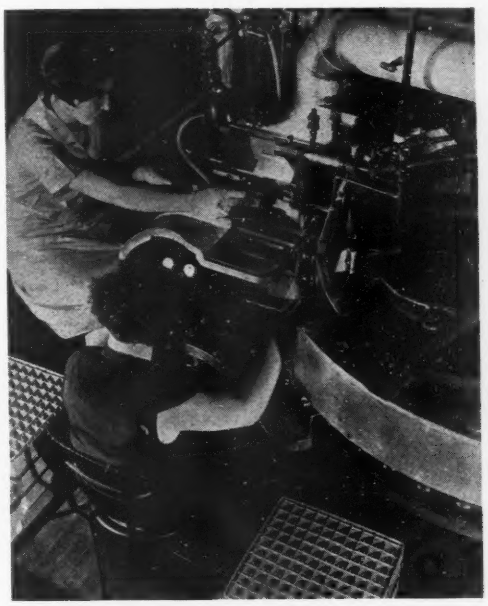
The Belt Bridge will be the only span across the Mississippi south of Vicksburg, Miss., which is about 300 miles above New Orleans.

SPRAY-PAINTING ELECTRIC BULBS

COLORED electric-light bulbs for signaling and decorative purposes are painted on the inside where the pigment is not exposed to wear. They used to be dipped, a method that was wasteful and not always conducive to good results: but now they are handled quickly by machine that turns out a uniform product at the rate of 6,500 a day.

A machine of this description is installed in the plant of the Westinghouse Lamp Company at Bloomfield, N. J., and is attended to by two girls—one inserting the delicate bulbs and the other handling the paint spray by means of which the coloring matter is applied. One after another the clear glass lamps make a complete circuit of what has been likened to a merry-go-round before they reach the nozzle of the spray gun. During this round trip they pass through a succession of gas flames that serve to heat the glass so that the paint dries soon after coming in contact with it.

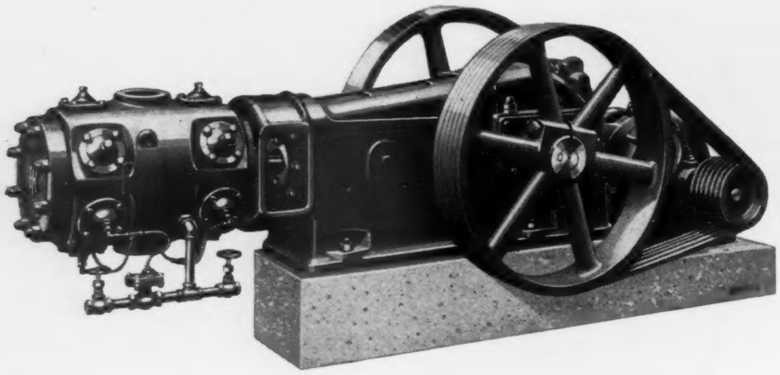
In the latest type of machine the nozzle automatically enters each lamp in turn; but in the one illustrated this is done by hand. All the while the painting is in progress, the nozzle sweeps from side to side of the preheated, rotating bulb, thus assuring a coat that is of uniform texture throughout. To bring this about it is necessary that the nozzle be kept clean, and for this purpose it is provided with a special cap that catches any dirt and particles of coloring matter. This cap is wiped automatically after the painting of every bulb. The spray gun used is of the DeVilbiss type and is supplied with air at 20 pounds pressure.

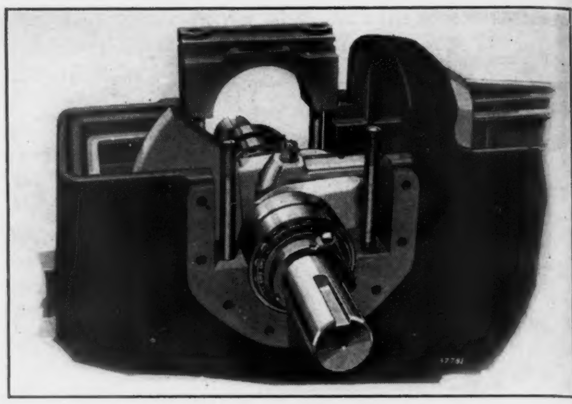


COLORING INNER SURFACES OF LAMPS

In the case of some colors—such as green, red, and blue, the lamps are painted twice and are required to make another circuit of the machine, the second trip through the gas flames baking the priming coat before the application of the top coat. The final operation consists of an inspection, and this is done by setting each bulb over a tiny tubular lamp that shows up any imperfections.

New Compressor for Heavy-Duty Service





COMPACT AND ACCESSIBLE

The ES compressor pictured at the left is arranged for Texrope drive and requires little floor space. Above is a view of the bearing assembly which shows the double row of Timken tapered-roller bearings on each end of the crankshaft.

THERE exists a widespread and increasing demand for a simple, dependable, and economical air or gas compressor for heavy-duty service. Particularly in industrial plants, but also in other fields of activity, there are many applications for a machine of this type that will operate with little attention, cost little to maintain, and will function for many years with no appreciable loss in efficiency. To fill this need better than ever before, Ingersoll-Rand Company has developed a new compressor which is designated the Class ES. In it are incorporated those features which the manufacturing company, during 60 years of experience, has found to be desirable.

The Class ES is a horizontal, single-stage unit with one double-acting cylinder, and is designed for operating at moderate speeds. It can be driven by Texropes, by short or long belt, or by a direct-connected motor. It is made in sizes from 10 to 125 hp., and for discharge pressures from 5 to 150 pounds.

This machine is especially suitable wherever full-load, continuous service is required and wherever power cost is an important consideration. It will give economical standby service for large compressors whose full capacity is not always needed. It is well adapted for use in isolated plants where there is little supervision, for all applications where oil in the discharge air is objectionable, or for installations where a future change in pressure conditions may call for a change in cylinder size. It will satisfactorily handle poisonous or flammable gases, or any others that must be handled without leakage.

The engineers who developed the Class ES sought to combine low power requirement or high compression efficiency with high volumetric efficiency, and they aimed further at sustaining these characteristics through many years of service. Designing the new unit with these objectives in mind, they worked out many improvements over previous compressor-engineering practice.

Liberally dimensioned stainless-steel valves of a highly efficient type, and correctly designed air passages, make for low air speeds and keep pressure losses down. Together with effective water-jacketing, they also insure low air temperatures, all of which effect better lubrication of and give longer life to the valves, cylinder, and piston rings, as well as good performance. Timken tapered-roller bearings reduce friction to a minimum and make bearing adjustments unnecessary for a long period of service. A noteworthy feature is the double row of roller bearings on each end of the crankshaft, which provides complete rigidity against any strains. The crankcase is dirt- and oil-tight and, since there is little oil agitation to cause evaporation, lubrication at low cost is assured.

The correct regulating equipment is furnished for any condition of service. Unloaders on all inlet valves provide for unloading the cylinder when starting or when only part of the available output is required. This feature materially reduces the total power consumption. Materials of construction are in all cases the best that are available for the respective purposes, and the workmanship is the product of skilled mechanics in modern, completely equipped shops.

When arranged for short-belt or Texrope drive, the motor is assembled on the same foundation as the compressor. This makes for a compact unit and reduces the time and cost of installation. On the other hand, the compressor may be driven by flat belt from existing shafting, if desired.

Complete details on the Class ES compressor may be had by requesting Form 3063 from the general offices of Ingersoll-Rand Company, 11 Broadway, New York City, or from any of the firm's branch offices.

DETACHABLE BITS MARKETED AS "JACKBITS"

"JACKBITS," announced by Ingersoll-Rand Company, 11 Broadway, New York City, provide an economical solution of the drill-steel problem for small contractors, quarries, and public-utility companies where the operation of a blacksmith shop with a sharpener is not warranted, or where the handling of machine-sharpened drill steels is unusually difficult or expensive.

"Jackbits" are detachable rock-drill bits which replace the conventional bits forged on the ends of drill steels. They are secured directly to the end of the drill rod by means of a sturdy, shallow, reverse buttress-type thread of a carefully determined angle. This distinctive thread keeps the bit tight while in use and makes it easily detachable for changing. The maximum hammer blow is transmitted through the end of the rod, close to the cutting edge, and there is no pressure on the threads.

Other features pointed out by Ingersoll-Rand are large clearance grooves to pass cuttings from the bottom of the hole, a countersunk hole in the center of the cutting edge which acts as a pilot to guide the bit, and cadmium-plating to prevent rusting and to minimize the loss of bits.

The hollow drill rods for "Jackbits" are made by the "super-smooth-hole" process, which has long been the Ingersoll-Rand standard. This method of manufacture is claimed to provide a smooth, uniform hole throughout the total length of the rod and to eliminate fatigue cracks and corrosive action which might result from a rough hole surface.

INGERSOLL-RAND "JACKBIT"